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PI/PD Name: Paul L Hill

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name): ☐

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PI/PD Name: Louis H Aulick

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☐ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

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PI/PD Name: Lawrence A Hornak

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

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PI/PD Name: Curt M Peterson

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
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PI/PD Name: Jan Taylor

Gender: ☐ Male ☒ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
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- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
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- ☐ None

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List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:

Dr. David Janes
Christopher Palmstrłm
Dr. Buhari Anthony Oyofo
Len Brillson
Dr. Kimberly Pacheco
Brij Moudgil
Jay Narayan

REVIEWERS NOT TO INCLUDE:

Not Listed

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 04-23

NSF 05-589 **09/16/05**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

EPS - RESEARCH INFRASTRUCTURE IMPROV

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

0554328

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
09/16/2005	**15**	**11080000 EPS**	**7217**	**928421387**	**11/10/2005 11:18am S**

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)

550517092

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

Higher Education Policy Commission

AWARDEE ORGANIZATION CODE (IF KNOWN)

6250004980

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

Higher Education Policy Commission
1018 Kanawha Blvd East Suite 700
Charleston, WV. 253012841

NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE

PERFORMING ORGANIZATION CODE (IF KNOWN)

ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS
☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Next Generation Biometrics: Achieving Strength in Molecular Recognition and Transport**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **8,999,903**	**36** months	**05/01/06**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.A)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.B, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____
☐ HUMAN SUBJECTS (GPG II.D.6)
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____
☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)

PI/PD DEPARTMENT
WV EPSCoR

PI/PD FAX NUMBER
304-558-2321

PI/PD POSTAL ADDRESS
1018 Kanawha Boulevard East
Suite 1101
Charleston, WV 253012841
United States

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **Paul L Hill**	**PhD**	**1983**	**304-558-4128**	**Hill@wvepscor.org**
CO-PI/PD **Louis H Aulick**	**PhD**	**1974**	**304-696-4837**	**aulick@marshall.edu**
CO-PI/PD **Lawrence A Hornak**	**PhD**	**1991**	**304-293-0405**	**lah@csee.wvu.edu**
CO-PI/PD **Curt M Peterson**	**PhD**	**1970**	**304-293-7537**	**cmpeterson@mail.wvu.edu**
CO-PI/PD **Jan Taylor**	**PhD**	**1985**	**304-558-4128**	**jtaylor@wvpscor.org**

Electronic Signature

CERTIFICATION PAGE

Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the individual applicant or the authorized official of the applicant institution is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, and lobbying activities (see below), as set forth in Grant Proposal Guide (GPG), NSF 04-23. Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

In addition, if the applicant institution employs more than fifty persons, the authorized official of the applicant institution is certifying that the institution has implemented a written and enforced conflict of interest policy that is consistent with the provisions of Grant Policy Manual Section 510; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the institution's expenditure of any funds under the award, in accordance with the institution's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Appendix C of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes ☐ No ☒

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Debarment and Suspension Certification contained in Appendix D of the Grant Proposal Guide.

Certification Regarding Lobbying

This certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Terry L Hess**	**Electronic Signature**	**Sep 16 2005 1:13PM**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
304-558-0679	**hess@hepc.wvnet.edu**	**304-558-0259**

*SUBMISSION OF SOCIAL SECURITY NUMBERS IS VOLUNTARY AND WILL NOT AFFECT THE ORGANIZATION'S ELIGIBILITY FOR AN AWARD. HOWEVER, THEY ARE AN INTEGRAL PART OF THE INFORMATION SYSTEM AND ASSIST IN PROCESSING THE PROPOSAL. SSN SOLICITED UNDER NSF ACT OF 1950, AS AMENDED.

A. Project Summary

This is a proposal to create a world-class research capability in molecular recognition, more specifically "molecular biometrics." Robust, low-cost instruments that can quickly and reliably identify minute quantities of molecular species would provide great advances in homeland security, health, forensic science, and other fields. Creating a center of research excellence in this field is a logical and realistic extension of established and emerging research and education programs in biometrics, nanotechnology, forensics, and molecular biology at West Virginia University, Marshall University, and West Virginia State University.

The stage for this proposal, *Next Generation Biometrics: Achieving Strength in Molecular Recognition and Transport,* has been set by prior NSF and WVEPSCoR investments. A solid R&D plan has been developed through collaborative planning, analysis of strengths and opportunities, and support at the highest levels of state government. Strength in physiological biometrics has been established through competitive awards, new faculty, and advanced equipment purchases. WV now seeks to improve research competitiveness and capacity through advancement of molecular-based automated biometric recognition. This tightly focused thematic area provides the means to embark on discovery at the intersection of nanoengineered and biomolecular targets widely understood to hold discoveries that will fuel technological innovations. Our strategy solidifies competitiveness in key supporting core areas of molecular biometrics and connects them through complementary, interdisciplinary research teams that include engineers, biologists, physicists, chemists and biochemists. These teams will engage in discovery linking materials, devices, and proteomics inspired by recognition and transport functions required for integrated molecular recognition systems. Faculty hires with significant start-up support are a major thrust of this proposal. To strengthen and bridge these nucleated inter-disciplinary research teams, WV requests critical NSF support to hire 11 new faculty at WVU (9) and MU (2).

The WV RII strategy has four primary objectives: 1) Organize discovery and innovation around the functional building blocks needed to build integrated molecular testbed systems; 2) aggressively build and bridge these crosscutting faculty groups through strategic cluster hires of faculty and postdoctoral associates at both WVU and MU; 3) solidify strategic collaborative relationships with industry and academic partners including WVSU and institutions outside of WV; and 4) enhance, institutionalize, and improve the shared facility environment as well as the academic environment necessary to promote discovery and learning activities of these groups and the institutional culture changes they have helped to launch.

This proposal is comprehensive with complete fidelity to NSF and state objectives. Integration of research and education will occur through a fully integrated human resources development and outreach program that includes a new partnership with WVSU, an historically black university. Underrepresented students and faculty will be recruited for the emerging technology workforce as the state's economy evolves. While advancing targeted fundamental science, NSF support will add long-term value by enhancing the opportunity for increased prosperity consistent with *Vision 2015*, the state's S&T strategic plan. A new state fund will significantly complement NSF and institutional support for this program. This project will be managed by an experienced team of researchers, faculty and administrators dedicated to leadership, evaluation, and merit-based achievement fully reflective of the multi-institutional partnership. Solid evaluation, metrics collection and sustainability plans are provided to ensure long-term competitiveness.

Intellectual Merit: Through the testbed exploration of novel co-integrated molecular recognition and transport functional building blocks, we will focus our basic discovery on defining enabling technologies for realization of integrated molecular recognition systems. From this integrated testbed approach, new knowledge and device concepts will emerge leading to innovations meeting biometric identification, health, forensic science, and other homeland security needs.

Broader Impacts: This program has the potential to not only advance fundamental science and technology, but to address significant infrastructure problems and enhance the prosperity of the State. Intellectual property will be proactively licensed to West Virginia companies. Underrepresented students will be recruited and prepared for emerging high technology jobs in the State and the nation. The collaborations between WV universities and partners outside the state made possible by this program will serve as models to encourage a more synergistic research community in the State.

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*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

C. Project Description

WVEPSCoR proposes to create a competitive research capability in molecular biometrics through leading edge research at the interface between molecular biology, nanotechnology and cyberinfrastructure technology. New knowledge generated by this work will lead to greater understanding of fundamental processes and will have potential applications in areas of health, homeland security, forensic science and other related fields. While advancing targeted fundamental science to benefit the nation, this NSF-sponsored research will build infrastructure and add long-term value by enhancing WV's economic prosperity.

1. Current Status of the Academic Research and Development Enterprise in West Virginia

Our strategic plan for science and technology, *Vision 2015*, recognizes West Virginia's strengths in traditional industries while focusing more heavily on the emerging areas of identification sciences and technology, biotechnology and environmental sciences. Governor Joe Manchin has called upon our universities to collaborate in providing a solid foundation for infrastructure enhancement "anchored by research and development partnerships among universities, government and the private sector"[1]. The Governor and legislative leaders have pointed to the WVEPSCoR program as a driver to help transform the state and create a stronger, more diverse workforce and knowledge-driven economy. As a result, the role of WVEPSCoR has been elevated to an independent office within the Executive Branch to manage a strategically focused statewide program. In this pivotal role, WVEPSCoR is working to build a vibrant state R&D community and focusing resources on a trajectory for sustainability.

During the past four years, EPSCoR investment in West Virginia has stimulated scientific research initiatives at both West Virginia University (WVU) and Marshall University (MU). This proposal, *Next Generation Biometrics: Achieving Strength in Molecular Recognition and Transport*, is intimately associated with these initiatives and further leverages state and institutional funding. Biometrics (automated biometric recognition) is traditionally defined as the automatic recognition of individuals through processing, storage, and comparison of digital records derived from measurable traits which are adequately unique for a given application (i.e. fingerprint, iris, face, DNA). This RII proposal focuses on advancing WV's academic and industrial infrastructure to compete on a national level defining the next generation of automated biometric recognition, hereinafter referred to as "molecular biometrics."

This RII proposal focuses on advancing West Virginia's academic and industrial infrastructure to compete on a national level defining the next generation of automated biometric recognition, hereinafter, referred to as "molecular biometrics."

Why Biometrics in West Virginia? Biometrics in West Virginia has been propelled by EPSCoR to a tipping point. WV has become a leader in biometric research and technology due to an early start in addressing identification technology research needs. In the mid-1990's, the FBI Automated Fingerprint Identification System and associated data repository came on-line in north central West Virginia, and planning for a related DoD facility began to emerge. In response, WV designated identification technology as a niche area and initiated a nascent research program through NSF EPSCoR, mobilizing the academic community to unite and serve these facilities. From this beginning, a state vision for biometrics and forensic science emerged as a magnet for subsequent public and private sector support and growth.

West Virginia continued to build a sustainable foundation for competitiveness in the field through ongoing state, university and NSF EPSCoR support. A comprehensive perspective was systematically developed through extensive internal discussions at all levels within the state and through external merit review. This comprehensive perspective has two critical dimensions.

1. Effective treatment of biometrics requires an interdisciplinary system-level approach spanning biology, devices, pattern recognition, statistics, and socio-legal issues.
2. Biometric system applications extend from organism to biomolecule and as such the full spectrum of biometric traits extends from the *physiological* to the *molecular*. While near-term opportunities for WV research competitiveness in areas that serve the national interest and need were clearly in physiological biometrics, ultimately, national recognition and competitiveness for large-scale awards requires that we advance both physiological and molecular biometrics.

In our 2002 RII, WV established a strong base in physiological biometrics and laid the groundwork for competitiveness in molecular biometrics. This proposal builds on gains made from our prior award and

leverages NSF, state and institutional resources to improve WV to a level of national prominence in molecular biometrics. The partnership with NSF has been the driving force for propelling WV's biometrics success.

Opportunities for Innovation The value of WV's comprehensive biometrics approach is recognized by others engaged in biometric research. Since the introduction of our perspective to the biometrics community at the 2002 International Biometrics Consortium Conference, two centers have emerged: The Center for Unified Biometric Systems (CUBS) at SUNY Buffalo and the Biometrics Engineering Research Center (BERC), a Korean ERC-like university consortium. To date, both centers remain focused on solidifying strength in physiological biometrics. WV, in this proposal, organizes crosscutting Nanoscience and Engineering (NSE) groups effectively focused on molecular biometrics as the next generation of automated biometric recognition.

WV's RII strategy has been to systematically target establishment of strength first in physiological and now molecular biometrics. Our 2002 RII results show the strength now established in physiological biometrics. (*See Section 2.*) WV is leveraging the fact that this technology underlies nearly every security system now under consideration by the Department of Homeland Security (DHS) and the Department of Defense (DoD). Our strategy for achieving strength in molecular biometrics recognizes that molecular recognition applications in security and health offer a comparatively less complex framework in which to develop our research foundation than human recognition based on DNA or other molecular signatures. Integrated biosensor systems for rapid direct detection of a broad spectrum of biomolecular targets are needed for realization of effective protection, response, and diagnostic scenarios related to a range of threats, natural and otherwise, from sophisticated biowarfare agents to simple biocontamination of food and water supplies to biomarkers for disease.

Successful formation of initial crosscutting NSE groups addressing basic discovery that serve as building blocks for these systems also resulted from the 2002 RII. We will build, equip and focus our interdisciplinary NSE groups in molecular recognition and transport around testbed co-integration of these building blocks. This will allow us to establish proofs of concept for integrated recognition devices addressing challenges in security and health. Through this progression of funded building block and testbed efforts, sustained contributions to the field will be made and strength in molecular biometrics established, leading our group toward the new EPSCoR SBRC and other large-scale centers.

We are confident that West Virginia's approach to biometrics with NSF EPSCoR support will enhance our position as an innovative leader in the biometrics community nationally. Realization of the nanoscience, engineering, and education (NSEE) culture and infrastructure that is integrated into our proposed RII plan is central to state S&T plans, academic programs, and workforce innovation leading to economic expansion.

WV's Institutional Partners. WVEPSCoR recognizes that research strength and objectives will be achieved through partnerships among its state research institutions. Each in-state partner is working with external partners that will be integrated to provide long-term strength in research design and implementation. (*See Outcomes and Objectives.*)

West Virginia University. WVU is a land-grant university with a Carnegie Doctoral-Research University—Extensive classification. Student enrollment reached 26,000 in 2005 with doctoral degrees granted in 34 fields of study. Three primary campuses in Morgantown include a Medical School and Health Sciences Center. WVU has invested substantial energy and funding to initiate and develop WVNano that is responding to a national emphasis on nanotechnology and biometrics, and is continuing work in the interdisciplinary triad thrust (bio-nano-info) leveraging support by the previous RII. WVU plays a leading role in this proposal.

Marshall University. MU also supports a growing medical school. The university has 16,000 students, 44 Masters and 3 doctoral programs, one of which is in biomedical sciences. MU has extensive interests in molecular and cellular biology – areas supported and developed through investments from the 2002 RII. This institutional priority is enhanced by growth in research faculty and a cell development and differentiation initiative within the Institute for Interdisciplinary Research (IIR). Participation in this RII will position MU's emerging molecular biology program for future competitiveness.

West Virginia State University (WVSU). WVSU, an 1890 Land Grant institution, is the third partner in this RII proposal. WVSU has 3,300 students and a growing masters program in biotechnology. WVSU is a historically black college and is playing a pivotal role in WVEPSCoR's education and human resources development activities to increase underrepresented students graduating and working in STEM fields.

State Commitment to R&D Improvement. The state's commitment to R&D improvement is demonstrated by historic state legislation passed in March 2004 that provides the first ever, long-range support for research. The Research Challenge Fund (RCF) provides a continuous funding stream (~$4.5 M/yr), and supports: 1) state contribution to NSF; 2) S&T research challenge grants for faculty to build on WV's existing strengths and expand into new areas, 3) graduate STEM education, 4) recruitment of eminent scholars, and 5) collaborative projects between higher education and K-12 to improve STEM instruction. The RCF is managed by the WVEPSCoR Office and Project Director/PI, Dr. Paul Hill, in partnership with Kay Goodwin, WV Secretary of Education and the Arts and Jay Cole, Education Policy Advisor to Governor Manchin. This arrangement gives the program unprecedented opportunities for strength, sustainability, and focus.

Other important initiatives that contribute to WVEPSCoR and leverage investments from the 2002 RII include creation of the WV NSEE Initiative (WVNano), and the Institute for Interdisciplinary Research (IIR). These activities provide a strength-based relationship with WVEPSCoR including shared facilities, faculty, partnerships and resources.

WVNano is the first WV university-wide initiative to transform traditional department level silos of expertise into multidisciplinary clusters focused on nanoscale science and engineering discovery. Established at WVU as a direct result of interdisciplinary team input from the prior RII, this initiative now encompasses efforts at MU and encourages both collaborative interests throughout WV and regional partnerships with non-EPSCoR institutions. WVU has committed $8.4M and 11 faculty lines to WVNano over the next three years.

IIR at MU is a new initiative to foster interdisciplinary scientific research. Within this structure, faculty will be provided innovative opportunities to interact with colleagues in various fields of scientific study for thematic research and for training future scientists. As with WVNano, this approach reaches beyond traditional silos of departmental research and training. MU President Kopp has pledged nine (9) new endowed faculty lines to the IIR bringing critical senior leadership to MU's junior RII faculty.

Strengths, Barriers, and Opportunities. WVEPSCoR is a visible advocate for strategic planning to transform the state from a "smokestack" economy to a diverse economy driven by knowledge industries. The long-term goal is sustained university research that makes major contributions in key areas nationally and that contributes to regional economic development and community needs. Significant strengths include:

- **Unified Vision and Unprecedented Support and Advocacy for R&D**. S&T policies and programs, including WVEPSCoR, are a keystone of the state's economic development plan. Historic barriers that have plagued the S&T enterprise are being removed, and WV's leaders are using WVEPSCoR as a catalyst to strengthen the S&T resources of the state.
- **Increased Research Capability and Competitiveness**. Past investments have allowed WVU and MU to strengthen available capabilities and tools to increase researcher competitiveness for federal research grants. NSF support for WVEPSCoR and competitive grant programs increased from just under $6 million in 2001 to nearly $11 million in 2003. In 2004, competitive research awards from all federal agencies totaled $53.2M, an increase of 88% from 2000.
- **Strategy Development**. Widespread consensus among state leaders is that WV must focus its educational, research, financial, and economic development resources on pathways most likely to create economic benefits. With WVEPSCoR's elevated state role, we are identifying, evaluating, prioritizing, and investing in focused targets of research opportunity, such as biometrics, for innovation-led growth.

Barriers and Opportunities. Historically, barriers to WV's success in research competitiveness have included: 1) insufficient resources – human, fiscal, and physical; and 2) institutional weaknesses in structural, organizational, and incentive-related policies. Insufficient resources continue to be an issue with higher education budgets being cut during the last two legislative sessions. On the other hand, research opportunities are greatly improved by establishment of the RCF and investment in research from the WVU Foundation, which sustains funding and allows for long-term planning and investment. Similarly, faculty teaching load policies continue to create problems for some research active faculty. Through this proposed RII, we are enhancing support systems, adding support staff,and modifying administrative policies on teaching loads and on hiring strategies. This will transform university culture and realize a substantially expanded R&D agenda. NSF support is critical. With past EPSCoR support, collaborative research teams have formed with expertise in molecular biometrics, and with this proposal, we plan to hire 13 scientists to complete and bridge these teams.

2. RESULTS FROM PRIOR RII SUPPORT

NSF investment in WV's research infrastructure has yielded increased competitiveness. Although WV's success rate for NSF grants has remained at about 17%, current RII faculty were responsible for half of all funded NSF projects statewide in 2004. Those in the core group of this proposal were funded at a 24% rate indicating a trend toward increased competitiveness among this group. Key results are summarized below.

- **People**: 8 hires have helped build the core of interdisciplinary teams conducting research at the nano-bio-info interface.
- **Tools:** Interdisciplinary research is now supported by critical shared instrumentation ($2.5M-NSF, $1.4M-match).
- **Ideas** : Key awards facilitated by RII investments: NSF - I/UCRC ($1.9 M), NER ($0.1M), ITR ($3.8M), 4 REUs ($0.4M); DEPSCoR nanoscience awards ($1.0M); NIH COBRE ($9.3M)
- **Research Culture**: Interdisciplinary cluster hires; stimulated interdisciplinary initiatives (WVNano; IIR); resource decisions based on external merit review and extensive planning; stimulated Next Generation Biometrics; RCF ($4.5M/yr)

RII investments and resulting awards have created a base upon which WV researchers can build to reach the next level of competitiveness. Specific results that led to this proposal are discussed more fully below.

Objectives and Specific Outcomes of the 2002 RII. The 2002 RII had two primary objectives: 1) to solidify competitiveness and national presence in physiological biometric recognition, and 2) to establish the groundwork for competitiveness in molecular biometric recognition.

Outcomes of Objective 1. Solidify Competitiveness in Physiological Biometric Recognition: The most dramatic outcome of the 2002 RII that solidified WV's national presence and established national partnerships in physiological biometrics was winning the NSF I/UCRC – CITeR (Center for Identification Technology Research). This was the first NSF I/UCRC focusing on biometric identification technology. WVU and the core CITeR team (Clarkson, Michigan State; St. Lawrence, Univ. of Pittsburgh) have received awards worth $6.4M from NSF, DHS, DoD, and industry.

In addition, the 2002 RII award led to other compelling changes. These include: a) two assistant professors hired with WVU funds in addition to one hired by the RII; and b) WVU was awarded two WV Research Challenge Grants ($400K,$500K) to promote biometrics research, economic development, and establishment of the Biometrics Knowledge Center (BKnC), which now provides program management for CITeR.

Table I illustrates WV's emerging leadership in the national and international biometrics community. These activities place WV in a position to: 1) define future directions in research; 2) establish national partnerships; 3) shape our proposed 2005 RII research agenda; and 4) remain at the forefront of emerging initiatives. The WVEPSCoR-initiated CITeR is now often cited by others including the national and international press for expert input (e.g. CNN, Technology Review).

Table I: WV Biometrics Community Leadership

Venue	Role
Invited Workshop on Advanced Face Recognition	Organizer, Site Host at the request of White House Office of Science and Technol. Policy
NSF Workshop on a Biometrics Research Agenda	Organizer, Site Host, Chairs, and Participants
National Academy of Sciences – Whither Biometrics?	Panelists and Participants
Department of Treasury/NSF Workshop on Resilient Information Systems	Biometrics Topical Group Leader
DoD BFC Science, Technology, and Innovation Steering Group	Steering Group members
NIST Workshop on E-Authentication	Biometrics Topical Group Leader
2003-05 Biometrics Symp. of the Int. Biometrics Consortium Conf.	General Chairs and Program Committee
M1 Biometrics Standards Development and Definition	Invited Participation by Government
International Conf. on Biometric Authentication, Hong Kong	Invited Topical Tutorial, PC

CITeR is also providing content expertise to the West Virginia High Technology Consortium supporting its recent certification as a National Information Assurance Program (NIAP) testing lab in biometrics and The WVU Small Business Incubator for support of selected product development relationships.

In conclusion, the 2002 RII stimulated and made CITeR a reality. Now the WVEPSCoR Biometrics Research Team, through CITeR, is serving as a catalyst for regional economic activity in biometrics and is the academic partner of the newly established DoD Biometric Fusion Center (BFC) in WV, along with Lockheed-Martin, the Computer Sciences Corporation and a host of small area technology companies.

Outcomes of Objective 2. Build the Groundwork for Molecular Recognition and Transport: To achieve this objective, WVEPSCoR identified near-competitive groups in: 1) biomolecular sciences (WVU chemistry and pharmaceutical sciences, and MU molecular biology), and 2) nano/micro science and engineering (WVU physics and electrical engineering). To strengthen these groups, we hired 2 new faculty at WVU and invested significantly in shared equipment and facilities. At MU, the investment strategy focused on hiring 6 critical faculty in biology and chemistry to strengthen the biomolecular component.

WVU greatly enhanced its NMR and mass spec capabilities through the 2002 RII. MU expanded its Genomics Core Facility by adding microarray capability and enhanced its Imaging Facility through addition of an atomic force microscope with a nanomanipulator. The total complement of equipment resources now available in each core triad area is described in the *Facilities Section* of this proposal. To further accelerate our competitiveness in molecular recognition, additional equipment is needed. (*See Section 4 and Budget*.)

In nano/micro science and engineering, we built materials/device research capabilities to solidify the bridge between physics and electrical engineering and to establish baseline materials growth, fabrication, and characterization labs to support nucleation of interdisciplinary investigations around novel device concepts. In WVU's Molecular Beam Epitaxy (MBE) growth capability, external funding was leveraged to establish the Multifunctional Materials (MFM) Laboratory in Physics. This lab includes 2500 ft^2 of specialized cleanroom space with multifunctional and stand alone MBE growth systems as well as microscopy, optical, magnetic and structural characterization. This laboratory and the newly established Metal Organic Chemical Vapor Deposition (MOCVD) Growth Laboratory provide state-of-the-art multifunctional material growth.

The WVU College of Engineering, Office of the Provost, and Lane Department of Computer Science and Electrical Engineering also provided $2.4M to construct the Nano/ Microsystems Engineering Shared Cleanroom with university and private donor funds. This 4000 ft^2 facility with Class 10, 100, and 10K spaces is now operational. This facility and facilities described above serve as both the campus and statewide resource hub for nano/microfabrication and the core of distributed lab architecture central to success of this proposal.

MU leveraged NSF investment in molecular biology faculty with investment of private, state, and other federal funds totaling $44M for a new research facility. The IIR facility currently under construction will provide over 55,000 ft^2 of research and research support space for faculty from the College of Science and the School of Medicine. Instrumentation includes: imaging and fluorescence methodology, DNA technology, functional genomics, proteomics and biological sample preparation. NSF help is needed to both equip and strengthen faculty lines (*See Budget*).

Table II: Nucleated Groups at the Bio-Nano Interface

Research Thrust	***Core Areas, Disciplines***	***Success to Date***
Fieldable Integrated Resonant Waveguide Photonic Biosensors	Biomolecular Sciences and Nano/Micro S&E – Chemistry, EE	ONR DoD EPSCoR Award
Nanokinematic Systems - Chip-level Actin-Myosin Electromotility Microassays	Biomolecular Science and Nano/Micro Devices – Chemistry, EE, Health Sciences, MU BioSciences	NSF NER Award, WVU Res. Corp Award
Electronic Characterization an Signatures of Molecular Species	Biomolecular Sciences and Nano/Micro S&E – Chemistry, Physics, Health Sciences	WVNano Research Initiation Award
Microfluidic Systems Modeling	Nano/Micro S&E – Chemistry, Physics	WVNano Research Initiation Award
Multifunctional Materials	Nano/Micro S&E – Physics – Chemistry – EE	ONR MFM Award
Nanostructures for DNA Characterization and Recognition	Biomolecular Sciences and Nano/Micro Devices MU Chemistry, WVU Physics	Army DoD EPSCoR Award

Additionally, MU nucleated molecular biology research groups from the College of Science and the School of Medicine to complement the move toward advances in molecular recognition and transport. MU research groups are identifying target proteins and biological markers to understand the molecular structure and function of targets for integrated molecular recognition devices.

Table II indicates interdisciplinary groups that have nucleated linking core groups and level of success to date. These groups form the collaborative groundwork for achieving the research objective of this proposal.

With competitiveness in physiological biometrics solidified by the 2002 RII, and initial framework for the necessary NSE and biomolecular foundation established, our goal during this proposed RII is to build on this framework to establish a strength-based collaborative in rapid integrated molecular recognition.

This interdisciplinary area of discovery is viewed as a critical enabling technology for applications of regional and national impact in security and health and is central to maintaining leadership in next generation biometrics.

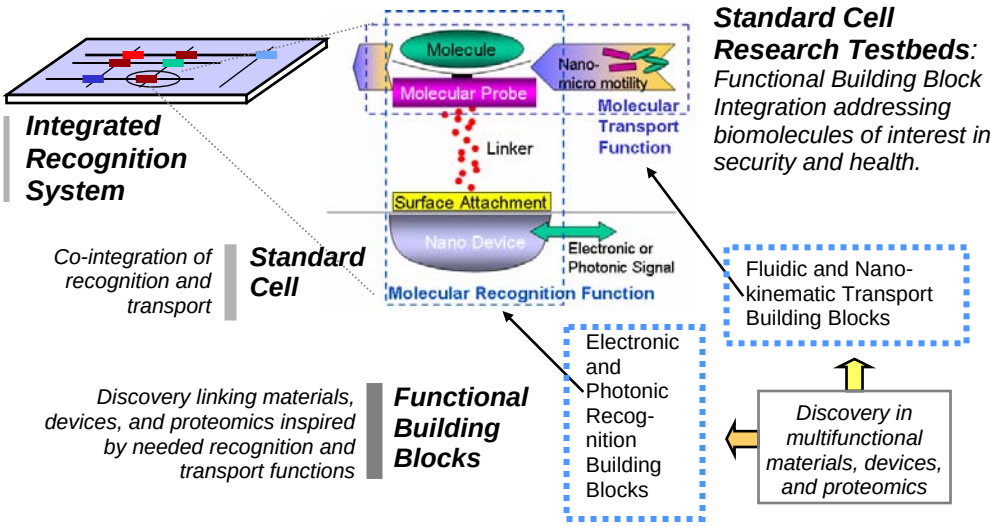
3. SELECTION OF RII ACTIVITIES, OBJECTIVES AND STRATEGY

The theme and strategy for this proposal are the result of a 14-month planning process undertaken by the WVEPSCoR Council and the universities. *Next Generation Biometrics* builds on strengths at WVU and MU through prior NSF and state investments and is aligned with the continuing state priority of strengthening academic and economic capacity in biometrics. To date, more than 30 businesses in WV have grown around university biometrics research.[2] Advancing our capabilities in molecular biometrics will open new opportunities for growing the research enterprise and for expanding WV's economic future.

RII Research Objective. Chip-level integrated recognition systems capable of renewable and rapid direct detection of a spectrum of molecular targets are of intense interest to the security, defense, and health communities. As with mature integrated technologies, a standard cell approach to building complex system functions from key device functional building blocks will ultimately emerge. This notion of standard cell recognition devices provides a useful conceptual framework within which to see the challenges facing realization of these systems and to motivate our central research objective. (*See Figure 1.)*

At the *functional building block* level, research individually advancing molecular recognition and transport is an area of growing interest. The 2002 RII defined and strengthened our core capacity for discovery in materials, devices, and proteomics. We have successfully achieved nucleation of critical interdisciplinary teams connecting these core groups, which are now addressing discovery targeting needed functional building blocks. The *standard cell* level is characterized by co-integration of specific molecular recognition and transport building blocks to achieve a desired recognition device function. Connectivity to the chip-level molecular transport network not only defines overall chip-level system function, but also establishes the material interface with the macro-world. This complements the electronic and photonic interface required for the physical transduction of molecular recognition. Despite its importance, the standard cell level remains comparatively under-explored in part due to the added challenges it presents. These include co-integration of a range of potentially multifunctional materials and design of not only the recognition components (e.g., transduction device and biolayer for specific probe and target combinations) and transport components (layout, field strengths, electrode structure, fluid dynamics) individually, but also their interdisciplinary co-design.

Figure 1: Integrated Recognition System Design



Based on external assessments of our research strengths and the fact that our interdisciplinary groups are still at a relatively formative stage gives us a unique position to solidify research in functional building block areas around achieving testbed standard cell device functions of application interest. Through these testbed efforts, solid contributions to the field can be made, and the basis of strength established. As a result, our RII research objective is to identify enabling technologies for achieving viable integrated molecular recognition standard cells through the testbed exploration of novel co-integrated molecular recognition and transport functional building blocks. Our selected testbed device standard cells will be inspired over the project period by an evolving set of security and health applications. Based on current research efforts, biomolecules of interest will be bioagent and chromatin/histone targets and enzyme probes. These are discussed in more detail in Section 4.

Strategy and Targeted Activities. Our strategy to achieve this objective has four basic elements.

1. Organize our research plan, teams, and group collaboration dynamics around the functional building blocks with which to construct integrated molecular recognition testbed devices.
2. Build and bridge these crosscutting faculty teams through strategic cluster hires and development of early career faculty and hires of postdoctoral associates at WVU and mid-career faculty and postdocs at MU. The hires will target voids in research expertise identified by the initial groups. These hires will address barriers to the pursuit of current and envisioned testbed inspired research.
3. Build strategic collaborative relationships with academic and industry partners which help bridge our capability voids, complement our strengths and accelerate targeted research.
4. Enhance, institutionalize, and continually improve the shared facility and academic environments necessary to promote discovery and learning activities of these groups, and the institutional initiatives and culture changes that these groups' activities have precipitated.

Objective 1: **Organize discovery and innovation around the functional building blocks with which to construct integrated molecular recognition testbed devices.**

Organization of research around testbed functional building blocks, as shown in *Figure 1*, provides a means to effectively manage, focus, and inspire basic science and engineering work based on device functional needs. This group organization leverages and couples WV's strengths in electronic and photonic materials and devices, and in molecular biology, proteomics, and microfluidics. By design, it mirrors and is a natural fit to the efforts of our successful crosscutting groups formed from the 2002 RII. It also enables device and system-level science and engineering issues such as hybrid and monolithic integration and nano-micro-macro interface issues to be addressed from the unifying perspective imposed by the need for functional testbed device operation. Execution of research threads woven together by testbed functions result in research products of greater interest to mission agencies seeking to understand the impact of work on their functional capabilities. Perhaps of most importance, this organization serves to strengthen and hone the connectivity and collaborative dynamic within and between each interdisciplinary building block group. The goal-oriented testbed approach serves to maintain and grow the cohesiveness between existing and new faculty, postdocs and students.

Objective 2: **Build and bridge these crosscutting faculty teams through strategic cluster hires and development of early career faculty and hires of postdoctoral associates both at WVU and MU.**

West Virginia University. WVU will hire 11 new faculty lines (nine technical faculty, one science educator, and a director) over the grant period as shown in *Figure 2*. Following recommendations from the WVNano Initiative Steering Committee, these *searches are now underway with the first ever university-wide cluster hire*. WVU has committed to faculty lines with competitive salaries ($70K/acad yr avg.), startup packages ($400K avg.), and reduced academic workload. To be successful, new faculty must be able to contribute immediately to interdisciplinary research groups. We will maximize success by: 1) selecting all hires from interdisciplinary groups so they are familiar with and can influence our culture regarding best practices, 2) having WVNano facilitate university administrative issues associated with startup, and, most critically, 3) investing NSF RII resources to provide summer salary, graduate students, and augmented materials support for each hire to immediately link their new ideas and tool capabilities to specific elements of our testbed research plan. In addition, we will also hire a cohort of four State and institutionally supported postdoctoral associates across the functional building block areas as indicated in the research plan below. Hiring activities will be augmented by the faculty support detailed in the EHRDO section of this proposal

MOLECULAR RECOGNITION	**MOLECULAR TRANSPORT**
Functional Building Block Groups **Photonic**: Explore and advance integrated photonic approaches for direct molecular detection *Group Foundation*: ONR Biosensor Effort, Materials and Devices Core Group **Electronic**: Explore the potential of molecular electronic/magnetic signatures for detection *Group Foundation*: WVNano Initiation Grant, Materials and Devices Core Group	*Functional Building Block Groups* **Nanokinematic Systems**: Explore addressable molecular motility for integrated environments *Group Formation*: Actin-Myosin NER, Device and Proteomics Core Groups **Nano/Micro Fluidics**: Explore nanoscale elements within microfluidic systems functionally coupled to macroworld *Group Foundation*: Proteomics
NEW HIRES: WVU: (1) Nano-bio Device Expert; (2) Nanoscale Imaging Scientist; (3) Surface Modification (Attachment) Chemist; (4) Optical Spectroscopist; (5) Nano-Fabrication Expert; (6) Structural Biologist/Biophysicist; (7) Theoretical (Computational) Nanoscientist; (8) Nano-Electro-Mechanical Systems Expert; (9) Supramolecular Chemist. **MU:** Two Molecular Biologists	

Figure 2. Building Block Groups and Hiring Plan

Marshall University. MU will strengthen its research culture by adding two (2) mid-career, senior leadership positions and emphasizing junior faculty development. An external review of MU's institutional and faculty capabilities identified these key strengths: 1) a select group of junior research talent and interdisciplinary research clusters developing between basic scientists at the College of Science and the School of Medicine in cell development and differentiation and 2) state-of-the-art research facilities under construction. The principal challenges are a lack of senior leaders to mentor and guide the emerging research teams and high teaching loads in the College of Science. This new culture will feature a stronger interdisciplinary research environment with financial, technical and mentoring support. Achievement will be measured by the level of competitive external funding, number of citations of peer-reviewed papers, and the placement of student graduates. In addition to attaining standard NSF awards, MU will seek to increase NSF REU and RUI awards, NIH AREA grants and other agency programs that target predominantly undergraduate institutions.

- **Strengthen the interdisciplinary research environment**. MU's new president (Stephen Kopp, PhD, physiology) has announced that the new $44M Biotechnology Science Center will be devoted to interdisciplinary research. Here, MU's RII faculty and other scientists will have state-of-the-art research laboratories and core facilities. Their teaching obligations will be reduced to no more than one 4-hr course per semester. This building will also house the Institute for Interdisciplinary Research (IIR) which President Kopp has committed to staff with nine (9) new, fully endowed research professorships. These full-time researchers will bring added expertise to the RII and considerable mentoring to MU's junior faculty.
- **Secure senior research leadership.** In October 2005, MU will initiate national searches for: (1) Dean of the College of Science, (2) Division Head for Biological Sciences, and (3) Director of the IIR. Successful candidates will have strong research backgrounds in cell and molecular science and interdisciplinary research, and thorough understanding of the role of EPSCoR in infrastructure development at the University and in WV. The Division Head and IIR Director will have and be expected to maintain nationally competitive research programs. Priority will be given those candidates with expertise in the molecular aspects of cell differentiation and development – especially protein recognition, protein networks, cell signaling and imaging.
- **Provide RII leadership**. NSF EPSCoR resources will be used to hire a mid-career expert in biomolecular recognition who will bring NSF award(s), R01 and/or other existing grants and equipment and their collaborative networks that complement the RII scientific thrust. Because this new hire will play a critical role in the WV molecular biometrics program infrastructure, Dr. Hornak (Technical Co-PI, WVU) will serve on the search committee. MU early career faculty will have a designated mentor. Mentors will be any of the established scientists listed above with competitive external funding.

Objective 3: **Build strategic collaborative relationships with regional academic and industry partners to bridge capability voids, complement our strengths and accelerate targeted research.**

The core of faculty expertise for CITeR was built successfully with the 2002 RII and then enhanced with national partners. In this 2005 RII, WV will build collaborative relationships in order to strengthen molecular biometrics as we build baseline expertise. These relationships, properly grounded in technical collaboration of mutual benefit, will help our new and existing faculty and accelerate our ability to achieve quality research products in the mainstream of molecular recognition. WVU faculty have made initial contact and visited the nanocenter at Carnegie Mellon University and also are exploring development of collaborative relationships with the University of Pittsburgh in supramolecular biochemistry and molecular x-ray characterization. We also are pursuing development of new contacts from collaborative relationships in the core scientific disciplines (e.g. DoD MURI, BU, GIT) and government agency relationships developed through CITeR. We will seek to grow our small business relationships (Protea, LLC; LA, Inc.) and extend these to larger firms.

Objective 4: **Enhance, institutionalize, and continually improve the shared facility and academic environments necessary to promote the discovery and learning activities of these groups and the institutional initiatives and culture changes these groups have precipitated.**

Our strategy addresses two distinct components of the NSE environment, shared facilities and the supporting academic culture. The EHRDO Section details the strategy for extension of the WVNano Initiative statewide to build NSE academic culture and to lower institutional barriers. A baseline set of core shared nano/ microfabrication and biomolecular analysis equipment has been established at both WVU and MU. This equipment will be augmented with additional shared equipment filling specific research needs. In addition, implementation of an effective management plan for the support, evolution, and increased user base of the shared equipment and facilities will be completed as summarized in the management section.

The second stage of our facilities plan will be a careful assessment of our distributed shared facilities model. Facilities are functionally clustered in the areas of fabrication, imaging/characterization, and biological prep spanning nano/micro and biomolecular sciences but distributed within the College of Engineering (shared fabrication facility), Chemistry, EE, Physics (imaging -characterization) and health sciences (bio prep) at WVU and between the College of Science (imaging) and the School of Medicine (genomics/ proteomics) at MU. To date, WVU efforts have focused on centralization of fabrication capabilities, now localized in the new shared cleanroom in engineering. Feedback from our researchers has prompted consideration of a more integrative approach to our State's NSE facilities. An architectural study focused on achieving an integrative, flexible research space where students and faculty of the interdisciplinary building block groups can interact and innovate will be undertaken. This vision 1) brings together core competitive interdisciplinary groups in the physical, engineering, and biomolecular sciences at both campuses and 2) bridges traditional academic program "stovepipes" and is consistent with objectives of *Vision 2015*, the new WVU 2010 comprehensive strategic plan, and the MU strategic plan for research.

4. RESEARCH INFRASTRUCTURE IMPROVEMENT ACTIVITIES

To achieve a research program that can produce sustained contributions to the research community, we are organized to establish a sustainable cycle of application-inspired functional building block basic discovery, its infusion into integrated testbed devices addressing application needs, and effective feedback of challenges arising from this integrated testbed work to influence the direction of further basic discovery.

In this section, we outline the: 1) S&E foundation of our current set of recognition and transport building blocks, 2) initial progression of emerging device testbeds combining the most mature building blocks, and 3) plans for use of these testbeds to explore integrated recognition for bioagents and biomolecules of interest in security and health applications.

Initial Testbed Application Scope. We first summarize the application space spanning security and health which will be the initial scope of both our current and emerging device testbeds and a subset of our building blocks. These represent an intersection of our current biomolecular expertise with applications and a useful range of physical scale and applicable sensor transduction mechanisms. We expect that the recognition application focus of current and emerging testbeds described below will evolve and expand as our team grows and as enabling functional building blocks emerge and mature based on niche application opportunities.

Bioagent Targets: Real-time detection of infectious biological agents is a critical security need. Biomolecular recognition is an indispensable tool for selective detection of target organisms and compounds. Antibodies are commonly used for detection of toxins and biomarkers.[3-6] More than 100,000 antibodies are commercially available, and are routinely used in assays such as enzyme-linked immunosorbent assay (ELISA) for detection of toxins and medical testing. Challenges to the use of antibodies include coupling them to the surface in a homogeneous and reproducible manner. To reduce non-specific binding and steric constraints the antigen binding fragment can be employed.[7-10] Other ligands such as short peptides can be used to bind selectively to the surface of bacterial spores,[11-13] and could prove to be ideal biomolecular recognition elements due to small size and ease of coupling with self-assembled monolayer (SAM) monomers. A variety of transduction methods can be used for direct detection of aggregate (refractive index, fluorescence) or potentially individual (electrical) binding events**.** Effective co-design of physical length and properties of this biolayer with the underlying physical transduction mechanism (e.g. optical, electronic) is central to reliably achieving and exceeding direct detection surface loadings of 1 picogram/mm^2. Current transduction approaches (e.g. surface plasmon resonance) are limited in their ability to flexibly achieve this co-design. The initial target with which to address this challenge in our testbeds is anthrax detection using a series of commercially available monoclonal anti-anthrax and anti-anthrax spore antibodies. Given the target can be changed by coupling a different molecular recognition probe with SAM monomers, testbeds should be widely applicable with appropriate co-design for detection of numerous large molecules, including protein biomarkers for disease.

Enzyme Probes: Enzymes selectively recognize chemical or biological substrates of interest with a high degree of selectivity and sensitivity. Upon binding a target molecule to an enzyme, a response is generated which can be a conformational change. It may be accompanied by selective processing of the target molecule to produce a product which may also serve as an analyte or secondary target. Many enzymes are selective in their interaction with target molecules, thus limiting their versatility. However, by site-directed mutagenesis, enzyme specificity and selectivity can be modified and targeted against any analyte of interest. Cytochrome P450 enzymes represent a class of enzymes that have been well studied for factors that control selectivity. P450 is manufactured by the human liver as a detoxification agent.[14] Site-directed mutagenesis has been used with these enzymes to alter selectivity. Incorporation of these enzymes into sensors has not been explored in any detail. The potential to use cytochrome P450 enzymes at the standard cell device level is largely un-explored though some reports have demonstrated building block proofs of concept. For example, cytochrome P450 2E1 has been immobilized on gold electrodes and shown to be able to detect p-nitrophenol.[15] Cyto-chrome $P450_{cam}$ has been immobilized in a variety of environments and used as a molecular detector.[16] Finally, cytochrome P450 CYP119 has been used to detect selected halogenated hydrocarbons.[17] A variety of methods can be used for detection and binding including refractive index, magnetometry, and direct electrical signal measurements. Thus, the combination of site-directed mutagenesis for designing target selectivity, available technology for chip integration, and multiple modes for detection, make cytochrome P450 enzymes good candidates for testbed evaluation. Aside from drug detection, likely target molecules for which P450 could be explored as a probe include chemical toxins (e.g., sarin, phosgene and mustard gasses) and explosives.

Chromatin and Histone Targets: Efficient and rapid detection of cell markers for specific nuclear functions or diseases is a challenging problem. Recently, post-translational modifications of histones, the proteins associated with DNA molecules that form the building blocks of chromatin or nucleosome, have been linked to specific cell functions and disorders.[18] These epigenetic modifications are also acting as targets for recruitment of numerous chromatin-associated proteins or complexes related to basic cellular functions, such as transcription or DNA repair.[19,20] The current technology, referred to as chromatin immuno-precipitation or Ch-IP based on antibody technology,[21] allows for detection of such modifications but is fairly cumbersome, time consuming and of limited sensitivity. Rapid molecular recognition of modified histones through specific known antibodies would significantly improve the sensitivity, speed and versatility of the identification of modified chromatin-associated proteins or complexes over methods currently utilized. Specific methods for detection of antibody-histone binding include charge and conformational changes as well as effective refractive index. Such an integrated system and approach would be invaluable to the rapid diagnosis of specific cellular states and, if arrayed, potentially enable construction of a “diagnostic signature” for any individual.

Initial Testbed: Microfluidicly Addressed SPARROW Device

Building Block Groups: Molecular Recognition Photonic FBBG and Molecular Transport Fluidic FBBG
Building Block Cointegration: Evanescent wave photonic transduction and microfluidic addressing
Initial Recognition Applications: Anthrax simulant, P450, Chromatin/Histone.

Integrated optical techniques exploiting evanescent wave interactions to interrogate specially engineered biolayers have received considerable attention as a means for molecular recognition.[22] Biolayers typically incorporate high affinity molecular probes, such as antibodies, to selectively capture targeted molecules. The underlying device designs often suffer from fabrication and optical alignment complexities, operational instabilities, or insufficient sensitivity that make them inconsistent with effective migration to field use. Our experimental results to date using sucrose solutions indicate that a new class of evanescent wave device based on a vertical stack of resonantly coupled slab waveguides can detect surface loadings of 0.2 nanograms/mm^2 with an optimized limit of detection expected to exceed 0.1 picograms/mm.[23] The integrated *Stacked Planar Affinity Regulated Resonant Optical Waveguide* (SPARROW) architecture shown in *Figure 3* reduces fabrication and optical alignment complexity, and our results achieved with ion assisted e-beam deposited alumina waveguides indicate the potential for high operational stability and sensitivity necessary for field applications.

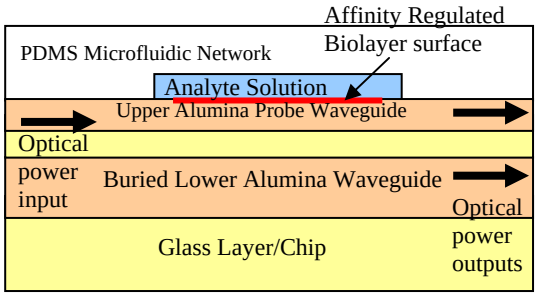


Figure 3: Testbed Architecture

The surface of the alumina probe waveguide is coated with SAM monolayers to prevent non-specific adsorption and add selective molecular recognition.[24-27] SAM monomers are terminated with polyethylene glycol (PEG) chains to prevent non-specific adsorption and bind to the alumina surface through both carboxylic acid or phosphonic acid head groups.[28-30] An aliphatic region between the terminating PEG and the head group increases SAM stability in aqueous and other polar solutions. To provide selective molecular recognition, PEG tails of a few percent of the SAM monomers are derivatized with biotin, which allows direct attachment of avidin. With the avidin surface, commercially available biotin labeled antibodies can be attached to the surface to impart biomolecular recognition. This approach provides an initial direct route for many proof-of-principle tests. In the future, antibody fragments will be attached directly to the SAM monomers.

Direct biolayer characterization must be combined with operational characterization in order to determine how the quality of the SAM layer affects performance. As a result, a mating PDMS microfluidic device is being developed as indicated in *Figure 4* for simultaneous fluorescence and transducer-based effective index measurements. Cointegration of microfluidics enables operational assessment of the effects of non-specific protein adsorption. The laser travels through the underlying alumina waveguide as shown, with interaction distances of approximately 1-mm or 2-mm, depending on which pair of channels is used and waveguide tuning. The sample is introduced on the left and moved over the sensor surface in a reproducible manner through the microfluidic channel as indicated by the flow arrow. As the testbed matures, alternative microfluidic network designs will enable controlled biolayer surface regeneration and sample introduction.

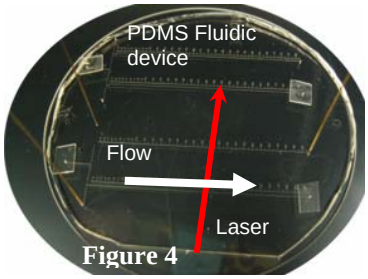


Figure 4

As the fluidic building blocks mature, we will also explore sample and reagent solution flow regulation using nanocapillary membranes to serve as molecular gates.[31-37]The microfluidic addressed SPARROW testbed device will serve as a platform for exploration of the stated recognition applications, and we anticipate leveraging its enabling components (waveguides, biolayers) in other building blocks and testbeds. As our first target, a mixture of contaminant simulant (standard proteins and cell lysates of *E. Coli*) and anthrax simulant (*Bacillus atrophaeus*) will be used to test the functionality of the device and evaluate performance of a single channel system. We will then use the testbed for exploration of the use of P450s for detecting large molecule toxins and explosives. Chromatin will be assembled in vitro or isolated from normal or modified cell culture

or tissue and fractionated to sizes from ~200 base-pairs up to 7000 base-pairs in order to determine size compatible with optimal evanescent wave interaction.[38,39]

Emerging Standard Cell Device Testbeds

The SPARROW testbed is first in a progression of testbeds which will be explored as functional building blocks mature. The makeup of anticipated next generation of testbeds is presented below. Details of their building blocks are found in the next section.

Microfluidicly Addressed Nano-Electronic Recognition Testbed
Building Block Groups: Electronic Molecular Recognition FBBG and Fluidic Molecular Transport FBBG.
Building Block Cointegration: Gold break junctions addressed by microfluidic network. Subsequent addressing of microfabricated cantilevers.
Initial Recognition Applications: P450 (using thiol group attachment to gold contacts).

Microfluidicly Addressed Photonic Crystal Recognition Testbed
Building Block Groups: Photonic Molecular Recognition FBBG and Fluidic Molecular Transport FBBG.
Building Block Cointegration: Photonic crystal defect regions addressed by microfluidic network.
Initial Recognition Applications: Bioagents, Chromatin (using SPARROW SAM-PEG biolayer).

Functional Building Block Research

The research of the four FBB groups is summarized below. Each summary profiles the current team, its challenges and needs, followed by description of its research threads.

Molecular Recognition Building Block Groups

Photonic Transduction Functional Building Block Group

Group: *WVU*: Korakakis (EE) and Timperman (Chem.) of the ONR biosensor group, with Gannett (P450, Pharmacy), Myers (multifunctional materials, Physics), Wu (Imaging, Mechanical Eng.). *MU:* Georgel (chromatin, Biology), Huong (Modeling, Physics), and Miksovska (conformation dynamics, Chemistry)

Challenges: Biolayer design for surface coverage and optimum physical coupling to device, biolayer-device interface characterization and imaging, specialized nanoscale fabrication.

Enabling Expertise: *Faculty Hires:* supramolecular chemist, surface chemist, nano-bio devices, nano-fabrication. *Postdoc Cohort:* One postdoc at WVU, in devices and biolayer design/char.

Needed Tool Improvements: XPS and XRD for characterization and advanced e-beam lithography system, Cl-based reactive ion etching system at WVU, Beckman-Coulter XL-A analytical ultra-centrifuge at MU.

Evanescent Wave-Based Transduction – See discussion under SPARROW testbed.

Photonic Crystal Mediated Transduction – Sensitivity of photonic crystal (PC) band structure and defect transmission states to refractive index changes either at planar boundaries of a 2-D crystal or at individual lattice sites make these structures potentially attractive for integrated point detection biosensor devices. This potential can be realized given that scalable geometries and materials suitable for microfluidic addressing and co-integration with source and detectors are achievable. Recent reports have shown experimentally the efficacy of single defect induced intra-band gap optical transmission peak shifts for detection of refractive index changes occurring globally in either superstrate or lattice void space.[40] We have undertaken analysis of single and cluster defects in hole and rod geometry 2-D PC lattices to assess use of PCs under selective addressing of cell clusters with micro/nano fluidic channels and under selective binding to crystal activated cell or rod surfaces by large biomolecules. We have analyzed optical transmission properties of Si and GaN semi-conductor PCs as a function of defect cluster size and refractive index to identify design windows with viable fabrication dimensions and measurable spectral shifts for specific ranges of induced refractive index change.[41,42] We will build on this work and fabricate PCs in these materials using e-beam lithography and enhanced lateral overgrowth (ELOG) techniques. Fluidic addressing will be used initially to evaluate cluster effects followed by the use of an appropriate attachment layer to achieve cluster filling by selective attachment.

The potential of PCs becomes even more interesting if the array is composed of active multifunctional materials such as electro-optic or semiconductor quantum well structures enabling incorporation of wavelength

selective source and detector structures. As the size and periodicity of photonic crystals scales from highly regular e-beam fabricated structures tenths of microns in size to controlled surface distributions of quantum dots or nanocrystalline rods of multifunctional materials such as ZnO or GaN, the optical bandgap closes and optical characteristics are expected to become dominated by surface-induced modification of nanostructure energy levels. This characteristic makes these structures of interest for biosensing given that selectivity can be achieved through effective biolayer design.

Integrated Spectroscopy – Using selective area growth (SAG) and the MOCVD method, we have fabricated 3-dimensional structures that can form microchannels (*Figure 5*) and have begun attachment studies of molecules to the exposed crystallographic planes. The structures grown and the functionality of the III-nitrides material system facilitate exploration of spectroscopic detection methods. In particular, UV-Visible emitters and detectors have been fabricated from GaN, AlN and InN and their alloys. It is advantageous to use these devices to capture the optical signature of biological and/or organic molecules. As the growth and fabrication technology of this material system matures other structures will be investigated.

Figure 5: GaN microchannels grown via MOCVD

Electronic Transduction Functional Building Block Group

Group: *WVU:* Lederman, Myers and Edwards (Physics) of the multifunctional materials group, and Korakakis (GaN growth, EE), Gannett (P450, Pharmacy), Timperman (Chem), and Flynn (VEGF, MRBCC), and Wu (Imaging, Mechanical Engineering). *MU:* Norton (DNA 2-D arrays, (Chemistry.).

Challenges: Nanofabrication, device design for nano-bio interface, prediction and interpretation of molecular behavior, molecular design, synthesis and attachment.

Enabling Expertise: *Faculty Hires:* Nano-bio device expert; structural biologist, biophysicist; theorist for *ab-initio* molecular calculations. *Postdoc Cohort*: One at WVU, for characterization and biomolecular attachment and one at MU for 2-D arrays.

Needed Tool Improvements: XPS characterization; advanced e-beam lithography system.

Molecular Electronic and Magnetic Signatures: Electronic techniques involve measuring electrical conductivity of single proteins. Initially we will study properties of cytochrome P450 proteins. CP450 activity can be significantly modulated by certain drugs that bind to its active site with toxicologically detrimental consequences.[43] At the heart of the CP450 protein is a Fe-based heme group. Recent work demonstrated that molecules with transition metals ions, such as Fe, have unique signatures in electronic conductance that depend on the valence state of the transition metal.[44] We intend to pursue this line of research using an electro-migration break junction technique that yields gaps between 1 nm and 10 nm,[45] as shown in *Figure 6*, which is ideal since the size of the protein is approximately 5 nm in diameter. Initial data indicate that the C450 molecule trapped in a nanocontact is sufficiently conducting at room temperature to detect these changes.

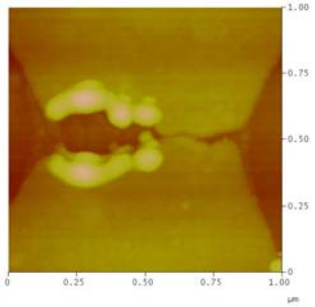


Figure 6: Atomic force microscopy image of a gold break junction created at a temperature of 5 K at WVU.

In addition to break junction work detailed in the nano-electronics device testbed, we are measuring electrical properties of natural nanowires, such as tropomyosin or actin filaments, proteins that regulate muscle contraction, and DNA. These molecules are ideal for making four-point contact measurements similar to those in carbon nanotubes[46] which are of interest for determining molecular electrical signatures.

Preliminary work at WVU shows that nanowires can be fabricated on four-point contacts via electron-beam lithography. MU is using DNA as an organizing molecule on metal templates fabricated at WVU to produce the equivalent of "tube sockets" to create well-defined sites for placing molecules on surfaces.[47] Selected molecules of interest can be covalently attached to DNA,[48] then integrated into DNA "bricks" (*Figure 7*).[49] In addition to simply binding and orienting target molecules, electrical contact to such macromolecules will be provided by selective metallization of the DNA, as described by Braun *et al.*[50] Electrical properties of these proteins may yield signatures that are unique to the specific bound biomolecule useful for recognition.

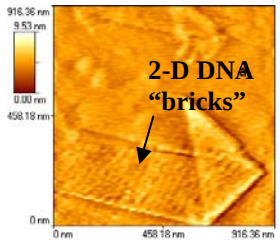


Figure 7 Tiling space with 2-D DNA "bricks", AFM image of arrays assembled.

Electro-Mechanical Detection Mechanisms: Mechanical detection methods are based on cantilevers where small changes on the mass load cause changes in the resonance frequency of the device.[51] By coating the device with antibodies, proteins binding to the antibodies can be detected.[52] This is a general approach that can be used to identify a wide array of proteins, giving it a large degree of specificity which has applications in both biomolecular recognition and as a diagnostic tool. As an example of usefulness, we have tested this approach to detect lung cancer marker proteins by coating microcantilevers with anti-VEGF in collaboration with the WVU MBR Cancer Center. Our initial experimental work, together with theoretical analysis, indicates that a factor of 10 to 100 improvement in detection sensitivity over standard techniques (ELISA) can be obtained. While measured with AFM here, integration with microcantilevers and microfluidics was recently demonstrated.[53]

Bio/Nanostructure Devices: Interactions between solid state devices and biological markers will be investigated at the nanoscale. Specifically, attachment of molecules to ferroelectric insulators or quantum dots and the resulting electronic signals detected via an underlying semiconductor device will be studied. New device structures based on dissimilar materials, such as ferroelectric (FE) on the polar semiconductors GaN or ZnO, have the potential to increase device sensitivity to electronic signals, stress or chemical adsorption by two or more orders of magnitude.[54] For example, attachment of a polar molecule to a receptor attached to a ferroelectric (FE) material may change the polarization of the FE thin film. When grown on a semiconductor, this FE film can act as a gate in a field-effect transistor (FET), and therefore a change in FE polarization will cause a drastic change in the FET current. The interaction with quantum dots, whose charge may be altered by binding to polar biomolecules, also can be used as a sensitive detector whose signal can be detected electronically or optically. We are currently investigating growth of high-quality FE $YMnO_3$ on the semiconductor GaN. Our long term goal is to bind biomolecular substrates to the ferroelectric surface to detect and recognize specific molecules.

Molecular Transport Building Block Groups

Fluidic Functional Building Block Group

Group: *WVU:* Timperman (Chemistry) of the Protea Biosciences fluidics effort with Edwards (fluidic modeling, Physics), *MU:* M. Norton (nanostructure reagent delivery, Chemistry).

Challenges: Modeling and prediction of micro and nanofluidic behavior, characterization and imaging, specialized nanoscale fabrication techniques.

Enabling Expertise: *Faculty Hires:* surface chemist, optical spectroscopist, supramolecular chemist, nano-bio devices, nanofabrication. *Postdoc Cohort:* One postdoc at WVU in microfluidics.

Needed Tool Improvements: Enhanced e-beam lithography and XPS and XRD for characterization at WVU.

Integrated recognition systems will contain functional nanoscale elements that are not independent systems. These nanoscale elements offer new and improved functionalities, and therefore development of a complete system that couples nanoscale elements with the macroscopic world is critical. This critical link can be formed with micro- and nanofluidic systems that can incorporate functions, such as sample collection, dispensing, modification, separations, and detection with the nanoscale element(s). Microfluidic systems are used for manipulation and transport of samples or reagents on the order of a nanoliter in volume. Nanoscale elements can be easily incorporated into the micro- and nanofluidic channels whose width and depth range from a few hundred microns down to a few nanometers in width and depth.

At WVU, microfluidic systems are being developed to couple protein separations and protein digestion or modification with the mass spectrometer which identifies the protein. Such systems provide new analytical technology for the emerging field of proteomics. As microfluidic building blocks for our integrated recognition testbed devices, these systems enable critical testbed optimization, both separate from and co-integrated with a corresponding recognition building block. Prior to co-integration, microfluidics can be used to understand retention of the probe and target molecule by the fluidic channels, and the surface chemistry necessary to block non-specific adhesion. Also, target molecule retention by the fluidic channel-bound probe molecules can be studied, and its effect on sensitivity of this additional, pre-device binding determined. Once co-integrated with the recognition building block, the microfluidic system enables delivery of the device modification

chemistry to the sensor surface, kinetic and reproducibility studies, and precision testing of target-probe chemistries. Through incorporation of nanoscale elements discussed below, the microfluidic system will also allow evaluation of the effect of various forms of pre-filtering on signal specificity. Finally, the system can be used to obtain a renewable testbed device bio-surface by controlling rate, total time, and composition of the detector surface rinse solution, and providing quantitative data on detector relaxation time and hysteresis.

Our microfluidic systems also incorporate nanofluidic components by coupling nanocapillary membranes (NCMs) with microfluidic channels. These NCMs promise to be important components of microfluidic systems for biological analysis as they can be used as analyte concentrators,[55] concentrating microreactors, and molecular gates.[56-61] Concentration factors of 300-fold can be achieved with NCMs in microfluidic channels, which greatly improves detectability for sample limited biological components at trace levels. Fundamentals of the NCM analyte concentration process are not well understood, and therefore we are studying the fundamentals of mass transport through the NCMs to gain a better understanding of the concentration process to provide more robust systems. Use of NCMs as analyte concentrators and flow gating devices are opposite in nature. In the NCM concentrator device, analytes are excluded from transport through the NCM, while in flow gating devices, an applied voltage is used to pass analytes through the membranes. Transport through different NCM and microfluidic systems is being characterized experimentally and theoretically modeled to determine how the numerous parameters control transport. Our initial continuum approach for modeling, involves both closed-form and numerical models of Navier-Stokes (fluid) equations, the continuity equation, mass conservation equations for each species, and Maxwell equations of electromagnetism.

Nanokinematic Functional Building Block Group

Group: *WVU:* Famouri, Hornak (EE), Gannett (Pharmacy), Timperman (Chem) of the NSF myosin group, new hires Carroll (myosin electomotility, Chem) and Wu (imaging, ME). *MU:* Blough (myosin, Biology).
Challenges: Motility assay stability and control, imaging, proteins in a non-cellular environment.
Enabling Expertise: *Faculty Hires:* surface chemist, nano-bio devices, nanofabrication, optical spectroscopy. *Postdoc Cohort:* One postdoc at WVU in motility assay, one post-doc at MU in myosin purification.
Needed Tool Improvements: High resolution fluorescence imaging, XPS; automated DNA synthesizer at WVU

Actin-Myosin Transport: Biomolecular transport of molecular cargoes has the potential to enable addressing of the surface of integrated recognition systems not attainable with microfluidics. Protein-based systems being explored as a means of realizing nanoscale transport mechanisms include linear and rotary biomolecular motors.[62,63] Due to its motor properties and because the myosin tail itself contains binding sections which could be exploited for cargo attachment, the actin-myosin system is an excellent candidate for study of protein-based linear biomolecular motor systems. In this system, myosin motor heads drive specific polymer filaments made up of protein monomers (actin) utilizing ATP as a chemical energy source. Harnessing the motion of this biomolecular system to achieve addressable molecular motility functions requires actuation rate control, directional control, cargo attachment to filament or motor molecules, and protein viability in a non-cellular environment. As the biomolecular transport systems evolve and mature, it is critical that the interface be established between their nanoscale motion and the chip-level microelectronic environment that will enable reconfigurable control of their nanoscale motion via electronic signals.

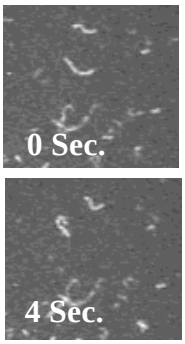


Figure 8: F-actin motility on heavy meromyosin (HMM)

Prior work has established macroscale electromotility characteristics of the myosin-actin system.[64] We will examine use of discrete electrical fields localized on the micron scale as a means of regulating the transport characteristics of linear biomolecular motor systems over discrete chip locations. We have already achieved progress in this regard. *Figure 8* illustrates our ability to construct and examine an actin-myosin based linear biomolecular system. Building on these initial efforts, we will investigate the interaction of electric fields on this biomolecular motor system, using integrated electrode structures under the assayed surface.

In addition to engineering challenges associated with the microchip assay, other difficulties include the particular conditions that biomolecular motors impose on their chemical environment. Along with the necessity of ATP to fuel movement, preservation of myosin activity requires that specific temperature, pH and ionic strength conditions be maintained. These needs represent a major hurdle to

widespread application of protein-based motors for chip-level molecular transport. Increasing the viability of protein-based motors can be accomplished through genetic engineering and isolation of proteins from organisms occurring in harsh environments. Attesting to the importance of myosin in cellular function, many exquisitely designed myosin molecules occur in nature that are able to operate under a wide variety of environmental conditions ranging from extreme heat, acidity and hypoxia.[65] To exploit this diversity, we will isolate myosin from organisms accustomed to survival in harsh environments. Cell culture using plates and/or bioreactors along with myosin isolation will be accomplished using standard methods where appropriate.[66] SDS-PAGE with determination of ATPase activity and electron microscopy will be employed to determine purity and enzyme functionality. As necessary, standard myosin isolation protocols will be modified, or alternatively, new methods developed. Once purified, myosins will be tested within the chip biomolecular motors platform. Manipulation of fields will be used to experimentally characterize their effect on linear biomolecular motor filament alignment, motion, and assay ambient. Fluorescence techniques will be used to optically observe actin motion in assay and mass spectrometry will be used to determine field effects on the integrity of actin and myosin. This work will serve as groundwork for research on electronically addressable nanoscale cargo delivery systems to serve as future integrated recognition system transport building blocks.

5. EDUCATION, HUMAN RESOURCE DEVELOPMENT, AND OUTREACH (EHRDO) ACTIVITIES

Design and Philosophy. Based on the premise that it is more effective to work to retain and enhance existing human resources than to recruit replacements, WV will focus its EHRDO efforts on students, early-career faculty, and mid-level faculty who are making the transition from individual research investigators to interdisciplinary educators and research cluster leaders. WVEPSCoR examined model programs for retention and enhancement of student and faculty performance in STEM, including those focused on underrepresented (UREP) groups including minorities, women, persons with disabilities, the economically disadvantaged, and first generation college students. Our plan is based on an extensive literature search of successful strategies and national model programs. *The significant innovation is the extension of successful existing programs for students to early-career and mid-level faculty in transition to interdisciplinary and highly collaborative ventures*. WVEHRDO uses principles, best practices, and components used by these nationally recognized programs including:

- NSF funded University of Maryland-Baltimore County's (UMBC) Meyerhoff Scholars Program for undergraduate and graduate students from UREP groups
- Kent State University's Undergraduate Mentoring Program
- The CGS and AACU Preparing Future Faculty (PFF) Program
- National Post-doc Association's Policies and Practices

Unless otherwise specified, all EHRDO initiatives are: (1) taking place at all WV institutions participating in the proposed RII; (2) targeted at the central scientific thrust of the RII proposal; and (3) focused primarily on UREP, undergraduate, graduate students, post-docs and faculty.

While this proposal focuses EHRDO activities on the research thrust, we will sustain EHR commitments made in the prior RII. We have a well thought-out program of proven components that focuses on education and human resource issues that WV must address to be competitive and to meet workforce needs in molecular biometrics as well as in other emerging areas of importance to the state. Our EHRDO goals are to: (1) better integrate RII research and education, (2) transform the academic culture and environment in a way that increases retention and graduation rates of STEM students and (3) enhance performance of faculty in molecular biometrics, and then to extend the most successful efforts to other WV institutions. Examples of ongoing programs that will be sustained by state and university funding include:

- $563K STEM Fellowships – 2 programs (WVU, MU); 13 doctoral students at WVU, 9 at MU
- $200K SURE Undergrads – 4 programs (WVU, MU, WVUIT, WLSC)
- $180K Instrumentation grants (8) and Innovation Grants (3) to faculty at PUIs
- $230K Governor's Schools for Mathematics and Science - (2) WVU;Nat'l Youth Science Fndtn. at NRAO
- $40K Mini Grants to Faculty – (8) at PUIs

These ongoing State-funded activities totaling $1.2M will be augmented by the $785K WVEHRDO request to NSF that focuses on student and faculty enhancement directly related to molecular biometrics.

WVEHRDO Problem Driven Initiatives. The recent NSF EPSCoR Planning grant, in addition to providing an opportunity to look at national models, allowed us to examine our programs and to identify and resolve problems impeding our progress.. Our strategies are designed to attack specific issues and problems important to sustaining our capability in physiological biometrics and growing the emerging area of molecular biometrics. Threaded throughout these initiatives is a heightened awareness of the need to diversify our workforce by providing increased access to individuals underrepresented in STEM and, in particular, the emerging field of molecular biometrics.

Issue: Undergraduate Students from UREP Groups. Only about 5% of the WV population is minority. Student data show that > 4,000 minority students are attending state 4-year institutions. Highest numbers were found at WVU (840), WVSU (728), and MU (577). In 2003-2004, 425 minority students were pursuing STEM discipline degrees at these institutions. Graduation rates are low: MU (12%); WVU (11%); and WVSU (11%).

Actions: UREP Retention Initiatives

WV will implement a comprehensive undergraduate retention program for UREP students modeled after the highly successful Meyerhoff Scholars program. We will adapt and implement components of this initiative. UREP undergraduate S&T retention initiatives at WVU, WVSU, and MU will use strategies that have been successful for a number of universities.[67] Dr. Charles Woolston, former Assoc. Provost and co-founder of the UMBC program, will assist in this endeavor. Activities below will be carried out on WVU, WVSU, and MU campuses during summer sessions and academic years throughout the project period.

1. ***Summer Bridge Program***. A six-week summer bridge program will be implemented to better prepare UREP students entering STEM fields, especially those closely related to nano-biosciences. We will recruit entering first-year students or rising sophomores at WVU, WVSU and MU who express interest in STEM disciplines but have not yet declared a major. Admission will be by competitive application. UREP students will enroll in a math and/or science course (s), interact with peer and faculty mentors, and engage in special academic support including class scheduling, career workshops, and other opportunities to become familiar with campus life including service activities.

2. Peer Mentoring and Tutoring. Intrusive (peer and proactive) mentoring during the summer bridge program and the undergraduate experience will ensure UREP are culturally and academically integrated into campus life, and will encourage retention in STEM disciplines through degree completion. A Mentoring Team will be established for each student, patterned after Meyerhoff and Kent State's[68] intrusive mentoring and retention programs. Each mentoring team will consist of a faculty member, an upper-class peer mentor and the student. Proactive mentoring is key to retention of UREP students in STEM disciplines.[69] A three-day workshop will train mentors at WVU, WVSU, and MU in campus resources, community resources, and life skills techniques and will follow the recommendations of Cross[70] and Redmond[71]. Students participating in the summer bridge program and in intrusive mentoring also will be provided with supplemental instruction outside of the classroom for gatekeeper courses (e.g., calculus and chemistry) to improve performance and encourage retention in STEM disciplines. Supplemental instructors will be identified from among successful upper-class students who also may serve as peer mentors.

3. Summer Undergraduate Research Experiences (SURE). A summer research experience in labs of faculty participating in the RII will be provided for UREP students following the second year of enrollment. The student will be assigned to work under supervision of a postdoctoral fellow or senior doctoral student. Students will prepare a poster presentation at the conclusion and present it at the RII annual conference. WVSU will institute a new SURE program for first and third-year students to parallel WVU and MU programs.

4. Louis Stokes Alliance for Minority Participation (LSAMP). UREP student opportunities will be complemented by WVEPSCoR's efforts with KYEPSCoR to fund a joint LSAMP program. A proposal is under development involving eight colleges and universities in WV and KY. WVU, MU, WVSU, and Fairmont State U. are participating in WV. Due to low minority populations in both states, KY-WV have joined in this regional partnership to form a multi-institutional alliance. The NSF Program Officer has visited both states, and all presidents have personally committed to AMP program goals and objectives.

Issue: Graduate Student Recruitment and Retention. National competitiveness in molecular biometrics requires high quality graduate students. In the competitive national environment, recruitment and retention of graduate students and post-docs is a continual problem.

Actions: Building the Graduate Pool and UREP Graduates and Doctoral Fellowships

1. Building the Graduate Pool. Activities to prepare students for entry into graduate programs will include a summer bridge program before the first year of graduate school including a Summer Undergraduate Research Experience (the SURE program currently supported by WV RCF), a GRE prep course, and mentoring by RII graduate students/faculty to improve preparation for graduate study.

2. Focused UREP STEM Graduates and Doctoral Fellowships. WVU and MU will recruit UREP STEM students at WVSU to enter doctoral programs related to molecular biometrics. This initiative will be patterned after NSF Alliances for Graduate Education and the Professoriate (AGEP) programs that have been successfully established at a number of university sites[72]. Additional recruitment will occur at WVU and MU campuses from among UREP STEM undergraduates and at all three campuses from master's students. Strategies will be patterned after the UMBC Meyerhoff Graduate Program.

Issue: Early-Career/ Junior Faculty. Obtaining the first competitive grant is the biggest hurdle junior faculty must overcome to launch a competitive research career and attain tenure[73.] The purpose of activities outlined below is to significantly increase competitiveness of junior faculty for NSF awards during the proposed RII period and to set the base for their participation in a large-scale Center-type award by 2010.

Actions: Meyerhoff-type Scholar's Program and Focused Enhancement Initiative

The focus of the Meyerhoff Program is on the best and brightest minority undergraduate students. The program wraps a comprehensive set of enhancement activities ranging from academic support to mentoring, research experiences, and social and cultural development activities. The evidence-based premise of the Meyerhoff is that even the best students will not succeed in STEM unless they are provided with a full set of support mechanisms. WV has hired talented young investigators that also need the same level of support to succeed. Therefore, with the assistance of Dr. Woolston, we have developed a developmental program for faculty modeled after the Meyerhoff. Below are the specific components of this innovative initiative.

1. Faculty Grant Development Support. Increase competitiveness of participating WVU, WVSU, and MU faculty by providing annual grant-writing seminars, which will be conducted by a nationally recognized firm. These seminars will be offered at the beginning of each academic year. Those who complete one of the basic seminars will be invited to continue working on grant development in a workshop series. Applicants will be selected on a competitive basis from two-page pre-proposals evaluated by the national firm and Research Offices at WVU, WVSU and MU. Participants will be given released time to ensure timely completion grant applications. The national firm will provide guidance for 4 to 6 months, with two on-site meetings.

2. Faculty Mentoring. Senior faculty mentors will be identified from among core faculty at MU and WVU who are participating in the RII research initiatives. To ensure mentors can devote sufficient time to working with 1-3 junior faculty or postdoctoral fellows, they will be given release time from teaching or service responsibilities. Mentors will meet with their mentees weekly, and generally be available for informal discussions as needed. Mentors will serve as reviewers of grant proposals as outlined above.

3. Mentoring/Training Seminars. Development of effective faculty mentors will be supported by bringing in science leaders who have won NSF's Presidential Award for Mentoring to both campuses twice-a-year. These mentors will present a series of seminars over a three-day period on successful mentoring strategies for students and junior faculty. Video conferencing will allow wide participation by all WV faculty.

4. Focused Underrepresented STEM Faculty Enhancement Initiative. WVSU STEM faculty will be invited to participate in all of the professional development activities at WVU or MU to nurture individual biometric, nanoscale, or biomolecular research interests. Annually, up to four WVSU STEM faculty will be provided stipends for summer mini-sabbaticals at MU or WVU. These faculty members will also select up to four UREP students (undergraduate or graduate) at WVSU to participate in this intensive summer experience.

Issue: Outreach to Industry – Collaboration on IP Commercialization. Research products often have difficulty reaching the marketplace and generating state prosperity. This component is to enhance WVU and MU opportunities to effectively transfer technologies through an established consortium of industry partners.

Action: Up to 40 invention disclosures will be assessed each year with emphasis on the target area. The WV High Technology Consortium will assist the universities in marketing and commercialization of intellectual property from this stream. The WVHTC is an organization focused on evaluating and commercializing technology through innovative, tech-based programs, products and services. WVHTC and university partners have established a Memorandum of Agreement to implement this initiative.

6. MANAGEMENT

Project Oversight. The WVEPSCoR Executive Leadership Team will provide technical and administrative oversight to ensure successful accomplishment of project milestones by effectively implementing, coordinating, measuring, and documenting project activities. The Team will: (1) evaluate progress of researchers and institutions in meeting annual benchmarks and project outcomes; (2) perform mid-course management corrections if necessary; (3) ensure effective stewardship of funds; and (4) develop increased and sustained collaboration, evaluation, visibility and program competitiveness.

WVEPSCoR will maintain its on-line database (HELIX), including quantitative indicators: 1) refereed journal articles; 2) conference presentations; 3) patents; 4) proposals submitted/awarded; 5) numbers of students, including women and minorities served by the grant; 6) number of STEM graduates (B.S., M.S., Ph.D.), 7) collaborations with institutions inside and outside of WV, 8) SBIR/STTR awards, 9) efforts with industry, non-profit organizations, school districts, and 10) new metrics from the Evaluation Plan. Faculty will submit reports via the HELIX Web Engine, augmented by SAS statistical analysis programs beginning in late 2005.

WVEPSCoR Governing Committee. The WVEPSCoR Council is vested with oversight and governance authority for the RII program and state-sponsored research and education initiatives. By directing both RII and RCF investment, the Council is ideally positioned to provide strategic portfolio investments that assure fidelity to *Vision 2015*. The Council (a) provides oversight and guidance on program implementation, (b) serves as liaison to institutions, industries, and businesses, (c) guides implementation and complementary support of WVEPSCoR and IDeA programs, and (d) directs the RCF in concert with WV S&T objectives. WVEPSCoR directly implements DOD and DOE programs; USDA, NASA, EPA and NIH programs are managed by effective committees that report to the Council via the State Director. Chairman Kay Goodwin, Secretary of Education and the Arts, is a member of the Governor's Cabinet. Members are appointed by the Governor, hold three-year terms, and represent government, academic institutions, and private sector industrial consortia.

WVEPSCoR State Council Members and Affiliations	
Ms. Kay Goodwin, Cabinet Secretary, WV Education & Arts	Dr. Curt Peterson, Assoc. VP for Research, WVU
Dr. Michael Mullen, Chancellor, WV Higher Education	Dr. Fred Butcher, Sr. Assoc. VP, Health Sci., WVU
Dr. Howard Aulick, VP for Research, MU	Dr. Paul Hill, State Director, WVEPSCoR
Mr. James Estep, Exec. Dir. WV High Tech Consortium	Mr. Steven Spence, Dir., WV Development Office
Mr. Jack Carpenter, VP Technology Bus. Develop., NTTC	Dr. Thomas Mann, President, Davis and Elkins College

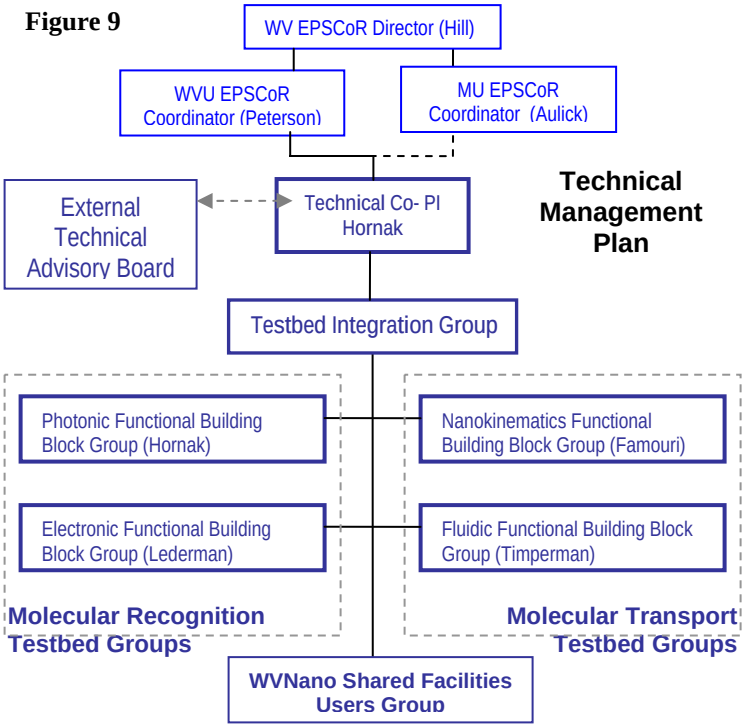
Executive Leadership Team (ELT)*:* The Team is headed by RII PI and **State Director, Paul Hill**. Dr. Hill has successfully managed WVEPSCoR over the past four years and has been an investigator on federal and private research awards including NSF. Co-PIs include **Dr. Jan Taylor,** Deputy WVEPSCoR Director who will oversee evaluation and assist in program management; campus EPSCoR Coordinators, **Dr. Curt Peterson,** WVU Assoc. VP Research and **Dr. Howard Aulick,** MU VP Research; and **Dr. Lawrence Hornak,** technical leader and interim director, WVNano. **Dr. Joe Kusimo**, Director of the Center for Advancement of STEM, will serve as campus coordinator at WVSU. Coordinators are responsible for campus technical and EHRDO implementation and information flow between the campuses and the State Director**.**

External Technical Advisory Board (ETAB): The Board is made up of national experts in the research focus area from non-EPSCoR research institutions and two EPSCoR State Directors. The Board will: (a) review biannual progress reports and provide advice and make recommendation for strengthening the RII Program to the State Director and WVEPSCoR Council Chairman; and (b) make two on-campus review visits during the award period and advise institutional officials and the Council on strengths, weaknesses and progress of the program. The ETAB helped evaluate, plan and develop this proposal. Two site visits were conducted in three months to ensure that strength-based approaches and sound science are being proposed. For the second review, experts with specific skill sets/disciplines were added to the team (Drs. Guiseppi-Elie, Graham, and Vulliet).

WVEPSCoR External Technical Advisory Board (ETAB)
• Dr. Scott Little, Program Director, SC EPSCoR, Columbia, SC • Dr. Michael Khonsari, Program Director, Louisiana EPSCoR, Baton Rouge, LA • Dr. Greg Salamo, Professor of Physics and Electrical Engineering, U. Arkansas, Fayetteville, AR • Dr. Graham Kerslick, Associate Director, Nanobiotechnology Center, Cornell University
• Dr. Anthony Guiseppi-Elie, Prof., Center for Bioelectronics, Biosensors & Biochips, Virginia Commonwealth University, Richmond, VA. • Dr. Jeffrey Graham, Research Physiologist-Marine Biologist, Scripps Institute of Oceanography, La Jolla, CA. • Dr. Richard Vulliet, Professor, Molecular Biosensing, University of California, Davis, CA • Dr. Charles Woolston, Former Associate Provost, U. Maryland Baltimore County, Catonsville, MD

Technical Management: An organizational chart for technical management is in Figure 9. Technical Co-PI, Dr. Hornak, is charged with oversight of research and management to achieve project objectives. Dr. Hornak will report on issues related to RII efforts to the WVU and MU Campus Coordinators. *Functional Building Block Group* (FBBG) Leaders will be responsible for research coordination and reporting responsibilities of efforts within their group. Planning, coordination and integration among the FBBG efforts to effectively organize, propose and execute funded research on coupled integrated system testbeds will be enabled through the Testbed Integration Group comprised of the FBBG Leaders and led by Dr. Hornak.

Figure 9



Research Coordination and Reporting Structure. Group progress will be tracked by use of quarterly technical reports and a hierarchy of comprehensive project meetings. The meeting schedule is structured to produce technical reports to be submitted by FBBG Leaders to Dr. Hornak each quarter. Dr. Hornak will supply necessary management data to WVEPSCoR. Each *Functional Building Block Group* will have biweekly meetings. The Leader, faculty, postdocs, and grad students will attend to avoid stovepiping and to encourage communication across FBBG efforts. Representatives from other FBBGs will attend to address experimental or data interdependencies and coordination, as needed. Project-wide *Testbed Integration Group* meetings of FBBG leaders will be held monthly to review Group efforts in context of the overall project.

Resource and Facility Management. We propose to build the Facilities Management Plan in stages. The first stage is institutionalization of support for existing facilities. Shared facilities user groups have been or are being formalized at WVU and MU to collectively plan and guide these resources in coordination with the colleges and departments in which they are located. A matrix management approach will be used to effectively align and coordinate university and college resource investments to meet identified technical capability objectives from users group at both universities. RII support is critical to phasing in this broad-based institutional commitment.

Technical Assistance. WVEPSCoR will reserve RII and state funds to ensure scientific, technical and management expertise and assistance are available to assist program development. Funds will support 1) expert review for investigators developing proposals to NSF; 2) management advice and guidance on project implementation; 3) bringing mentors and/or workshop speakers to WV; 4) bringing the External Technical Advisory Board to the state for expert reviews; and 5) assistance in development of partnerships with industry and collaborations building toward strength-based research collaborations that will lead to large scale, center-type awards. In addition, technical assistance will be provided under the EHRDO activities.

Dissemination and Communication Strategy. WVEPSCoR's communication strategy is multifaceted and focused on stakeholders from faculty and students to state legislators and the public at large. Dissemination and communication are vital components of the effort to elevate the WVEPSCoR program. Both the current and previous governors have shown strong interest in EPSCoR, promoting the program in public speeches and documents such as the State-of-the-State address, legislative language, Executive Orders, and official events. Governor Joe Manchin's Administration and WVEPSCoR are committed to this communications strategy of promotion at the highest levels of government. In addition to maintaining its high-profile in state government, WVEPSCoR will also: 1) continue publication of the WVEPSCoR Newsletter: *The Neuron*; 2) maintain a modern, technologically dynamic website; 3) promote science-based news stories in print, radio, and television including a new Public Broadcasting program hosted by the WVEPSCoR Director; 4) hold/participate in special events, meetings and conferences; 5) participate on boards, commissions and foundations that promote science, STEM education, tech transfer, and knowledge-based economic development; 6) publish profiles, from time to time, of lead scientists who achieve milestones, major awards, patents, successful student achievements, peer faculty awards or other meritorious outcomes; 7) promote *Vision 2015*, and 8) disseminate discoveries to refereed journals, and national organizations including NSF. Activities are budgeted in excess of $100K annually and are staged through the year to achieve continuous and increasing levels of information about WVEPSCoR and research foci at WVU and MU. Each university will assist central communication efforts with campus events, news releases and facilitation through institutional communication offices.

Summary of Key RII Implementation Milestones

RII Milestones	End of Year One	End of Year Two	End of Year Three
New Research Faculty	Advertised, interviewed at least half; start-up packages in place; hired 2 at MU; collaboration begun	Hired 5 WVU; integrated into FBBGs; hires include UREP; actively involved in collaborative research	All hired and are actively publishing and submitting grant proposals in molecular biometrics
Research Instrumentation	Purchased, installed at WVU and MU (as scheduled in budget). FBBGs began use in research.	Purchased, installed at WVU and MU (as scheduled in budget). FBBG use led to journal submissions	Use led to significant research reflected in patents, journal submissions and publications
Faculty Development	Grant writing seminars; increased proposal submission; current jr. faculty received first award; 2-4 UREP mini-sabbaticals initiated	Increased proposal submissions; increased single investigator awards; 25% have applied for IGERT or NER; 2-4 UREP mini-sabbaticals	Doubled number of research awards; increased nanoscale grant awards (metric met);mini-sabbaticals led to research collaboration
Molecular Biometric Research Collaboration	Strengthen collaborative research and mentoring; targeted proposals submitted advancing and linking FBBG projects.	Effective WVU/MU partnership; FBBG awards; developed external university and industrial collaborations, joint proposals.	Collaborative research awards with university and industry partners; Competitiveness as a center team partner based on niche strength.
Post-doc, Student Development	Proposed EHRDO plans fully implemented; post-docs integrated into research teams	Significant molecular biometric research experiences for graduate students and undergraduates	Post-docs published and submitted proposals; increased STEM graduate program applications
Underrepresented STEM student retention	Retention activities initiated at WVU, MU, and WVSU; first cohort formed	Retention activities continued with cohorts 1 and 2; measurable increase in retention of first cohort	UREP STEM student retention approx doubles; successful activities disseminated to other PUIs

Management	Council and Mgmt. Team meetings resulted in targeted infrastructure improvement; technical assistance provided; milestones accomplished	Effective leadership resulted in 30% increase in grant funding; enhanced STEM appreciation in WV resulted in doubling RCF.	Impacts and achievement strategies applied and WVEPSCoR and its partners clearly sustaining improvements supported by NSF
Evaluation	Implemented as planned, formative results used to improve project implementation.	Progress evaluation documented progress toward attaining metrics; accountability project-wide	Process evaluation findings continued to be used. Evaluation now summative; SWOT analysis
External Technical Advisory Board (ETAB)	Review semi-annual reports; provided feedback; recommend-ations reviewed and implemented	Reviewed semi-annual reports; on-site review of molecular biometric research groups; recommendations	Review semi-annual reports; on-site review of molecular biometric research groups; recommendations
WVEPSCoR Research Conference	Conference featured NSF pro-grams & officers; experts from core disciplines & molecular biometrics interacted with scientists	Conference featured university & industry scientists, post-docs, and graduate & undergraduate students; experts from nanocenters	Research conference featured all RII participants, NSF officers, mission agency program officers for broad dissemination;

7. SUSTAINABILITY STRATEGY: PLAN TO SUSTAIN IMPROVEMENTS AFTER THE AWARD PERIOD

Infrastructure improvements will be sustained through: 1) maintenance of improvement in long-term sponsorship of junior and senior faculty research positions, technical support and equipment secured by state and university funds; 2) continuous efforts to build the RCF; 3) increased number and competitiveness of individual, group and large-scale multidisciplinary proposals from all faculty, research clusters and partners; and 4) building stronger research collaborations between universities, federal R&D, technology transfer, and private industry facilities both in and outside WV. In addition, implementation of *Vision 2015* will improve policies, financial and infrastructure support for the research enterprise in West Virginia.

The appended letters of commitment demonstrate long-term support for this research at the highest levels of institutional and state fiduciary responsibility. WV and partner universities in this proposal are committed to long-term sponsorship of faculty positions created or dedicated to the RII initiative. Committed support for faculty will be sponsored by permanent institutional budgets henceforth. After attracting and nurturing competitive research faculty, WV has committed to continuous, long-term support, and will also pursue every avenue to enhance the research environment, from competitive compensation to collegial interests. Equipment, maintenance, and supporting infrastructure including technicians will be addressed by long-term state and institutional commitments.

Research competitiveness brought about by proposed NSF support and the prior RII is a major component in WV's long-range sustainability plan. Start-up packages and summer salary for faculty ensure a period of developmental support that initiates access to mainstream research programs at NSF and other federal agencies. As junior faculty competitiveness grows through mentoring by senior, competitive faculty, a self-sustaining program amenable to metric evaluation will be achieved. (*See Logic Model*)

As demonstrated by CITeR, sustainability also is being attained through financial partnerships with industry. CITeR's business partners and research portfolio include strength-based partnerships with Lockheed Martin, Computer Sciences Corporation, the WV Small Business Incubator and the US Department of Defense, Biometric Fusion Center. Partnerships are evolving with the University of Pittsburgh and Carnegie Mellon University. These partnerships and co-sponsors of research ensure a growing and sustained relationship with industrial partners that will exist beyond the RII due, in part, to the foundations provided by it.

Strategic Plan for Science and Technology, *Vision 2015* . In 2004, WV began revising, and strengthening its strategic plan for science and technology. With assistance from a NSF Planning Award, the WVEPSCoR Council met with state leaders, technical experts, academic leaders, and economic strategists to produce a new S&T plan. Council leadership drew on a comprehensive study of WV's tech-based industries (Lester, 2004) and polices and guidelines in *A Vision Shared!*, the WV economic development plan. The resulting *Vision 2015* initiatives will lead to improvements in 1) Education & Outreach; 2) Financial Resources; 3) Research & Innovation; 4) Human & Physical Infrastructure; 5) Economic Development; and 6) Policy. This plan reinforces and guides proposed RII investments.

To support new faculty positions, new research cluster development, start-up packages, and additional STEM student enhancements, *Vision 2015* calls for a sustained and dramatic increase in Research Challenge Funds.

The Plan, which has received endorsement from top state leaders including Executive and Legislative chairmen, aims for a ten-fold increase (to $45M) in RCF resources over the next decade.

8. EVALUATION AND ASSESSMENT PLAN

The WVEPSCoR Evaluation and Assessment Plan is based on recognized methods and professional guidance. The Evaluator, Rose Shaw, Ph.D. in Applied Statistics, M.S. in Mathematics and B.S. in Mathematics and Biology/Composite Science has extensive experience evaluating NSF-funded projects including a GK-12 project, a Team 2000 project, a middle school mathematics LSC, a teacher enhancement project, a 5-year CETP collaborative and the 3-year outcome evaluation of the CETP. In 2004 she was a member of the NSF team that made the critical Phase I site visit to evaluate the North Carolina Mathematics and Science Partnership for Improving Math and Science at the University of North Carolina-Chapel Hill. She has evaluated numerous projects that included equitable-access components (e.g., NSF's Phases I & II of the Louis Stokes Colorado AMP). She completed a retrospective evaluation of WVEPSCoR's current NSF RII grant in August 2005. She is the evaluator of National State-to-State Technical Assistance Program that provides technical assistance to states with grants funded by the Federal Centers for Medicare and Medicaid Services. She taught university mathematics for 20 years and is owner of Metrica, a company that specializes in statistics, evaluation and assessment.

The project's logic model of people, ideas and tools goals, inputs, activities, outputs, outcomes (short-term, medium-term and long-term), and metrics will provide the framework for evaluation[74.] Qualitative and quantitative data will be used in a mixed methods evaluation[75.]The purpose of the formative evaluation is to collect a combination of measurements and judgments before and during implementation of the project to control, assure and improve quality of performance, processes and deliverables. Summative evaluation will be conducted for accountability and will determine overall project effectiveness and impact. Some relevant formative evaluation data and results will be used in the summative evaluation.

Formative evaluation activities in this project will continue through its entirety with a focus on implementation and progress evaluation. Implementation evaluation will compare operational activities to the project's management plans to determine if the project is being conducted as planned. Qualitative data (observation, document analysis, records, and debriefing sessions) collected for the implementation evaluation will provide information that will help refine plans, characterize the extent plans were implemented, and identify barriers along the way. Progress evaluation will assess the project's progress toward meeting its annual milestones and will evaluate unexpected developments as well as the project's strengths and weaknesses. Qualitative data (observations, expert reviews, peer reviews, testimonials, written surveys, email surveys and semi-structured interviews) will be collected, analyzed, and reported along with evaluation recommendations. These recommendations for project improvement will benefit from an external view strengthened by confidence in the Evaluator's adherence to the four evaluation standards: utility, feasibility, propriety and accuracy[76.]

Process evaluation will be especially important in evaluating the effectiveness of activities used to improve quality and broaden participation of UREP student in STEM at the three universities and expansion to WV public universities having the greatest numbers of underrepresented students (women, minorities, students with disabilities, low socioeconomic, first-generation). Since fidelity of implementation of the components of models used in the EHRDO problem-driven initiatives (e.g., Meyerhoff Scholars Program) is important for duplicating success, essential components used in the project will be evaluated by studying the quality of the activities within each of these components, by interviewing component participants and administrators and by using the same outcome measures used in the original models. The impact refinements and adaptations of these models had on success with UREP students will be evaluated by analyzing data disaggregated by UREP group. Participants and leaders of bridge programs, mentoring, supplemental instruction, mentoring workshops and summer research experiences will be interviewed periodically and samples of sessions will be observed. Evaluation results will be used to refine and improve these activities.

Participatory evaluation[77-79] will be the gateway to culturally sensitive evaluation since this model ensures that the priorities, perspectives and insights of a diverse group of people are considered. The Evaluator will collect and analyze data and then will support the management team as evaluation results are used to build capacity that supports a multicultural citizenry of scientists and engineers. The process of self-assessment, collective knowledge generation and collaborative action will create a learning process for effectively reaching the project's goals[80.] UREP faculty and students will be full participants in the evaluation of retention.

In the spirit of participatory evaluation, during the first three months of the project, the Evaluator will work with the Executive Leadership Team to develop a set of specific, measurable, attainable and quarterly time-based objectives with performance measures that will be used to assess project progress toward meeting end-of-year milestones, and ultimately, the people, ideas and tools goals. This process will be instrumental in embedding timely oversight and accountability project-wide while building both intra- and inter-institutional collaboration. This process will be revisited in late summer or early fall of the first and second years in order to update these plans and to bring new faculty and administrators "on board." Stakeholder turnover can impede progress toward meeting goals and building sustainability. A one-day mid-project assessment symposium led by the Evaluator will be convened at the end of the first year to thoroughly vet overall project direction, assess progress towards attaining milestones and metrics, and to make recommendations for improving implementation. The Evaluator will submit quarterly reports to the Deputy WVEPSCoR Director, who will be responsible for sharing results with the Executive Leadership Team. Short-loop evaluation feedback will be reported by email and telephone. Annual reports will assess implementation quality, quality of activities, progress toward meeting annual milestones and impact on the students, faculty and institutions.

The metrics will be the primary measures for assessing project success. In addition, the evaluation will adopt a quasi-experimental design comparing program students and institutions to non-participants whenever possible.

- Assessment of the project's research and capacity building success will be gauged by the metrics displayed in the logic model. The Evaluator will be assisted by the WVEPSCoR office in collecting these milestone and metric data from WVU and MU.
- Education, Human Resources Development and Outreach metric data will be collected by the Evaluator and WVEPSCoR in collaboration with the universities' institutional research divisions. EHRDO retention and graduation data will be compared institutionally as well as nationally through comparisons to national LSAMP and AGEP data.
- Since the depth and breadth of inter- and intra-institutional collaboration is the responsibility of the project's management team and each institution's leadership team, effectiveness of these teams in building increased and sustained collaboration, visibility, and program competitiveness will be evaluated by review of meetings, their objectives and results along with information from the ETAB external reviews. Since increased collaboration is an essential part of this project, participants (students, faculty and administration) will be interviewed each project year so that collaboration progress, obstacles, successes, and areas of improvement can be summarized and shared with the Executive Leadership Team. Collaboration will be evaluated in depth using three metrics: (1) Usage (Who is using what how frequently?), (2) System usability (How user-friendly is the system?) and (3) Processes and outcomes (What is the impact on users?) as described at http://collaboration.mitre.org .
- Technical assistance (TA) will be evaluated formatively by participants and providers using web-based surveys. Surveys will be developed by the Evaluator and the Executive Leadership Team. The Evaluator will work with technical assistance providers and recipients in developing specific TA objectives and metrics for each major TA activity. The impact of each of the TA components will be evaluated using these objectives and metrics; effectiveness of TA during each year will be assessed by attainment of milestones. Long-term effectiveness of the TA for building competitiveness will be documented through annual interviews with TA recipients as well as project productivity metrics.
- Since the climate supporting research and diversity in faculty and students is crucial in this project, an institutional climate survey will be developed using the school climate survey administered at the NM-AGEP in 2004. The survey will be completed by MU, WVSU and WVU junior faculty, new hires, established faculty and students (UREP and non-UREP) at baseline and mid-way through year three. The survey will include questions pertaining to quality of mentoring, student advising, social bonding structures, conduciveness to graduate study and research as well as other questions informed by the ongoing formative evaluation.

Other aspects of the evaluation will be coordinated within this framework to address: 1) building integrated molecular recognition testbed systems;2) bridging crosscutting faculty groups through strategic cluster hires of faculty and postdoctoral associates; 3) building strategic collaborative relationships with academic and industry partners to accelerate development of targeted research; and 4) enhancing, institutionalizing, and continually improving the shared facility and academic environments to promote discovery and learning.

Project Logic Model

Long-Term Metrics

- Increased nanoscale awards (IGERT, NIRT, NER) from the current level of one to 9 awards.
- Double the number of NSF research awards from 38 to 76.
- Double the number of refereed publications from MU and WVU
- Increase the number of patent applications from 23 to 30.
- RII junior faculty will each obtain 2 competitive awards within 5 years. of appointment
- 50% graduation rate increase of UREP STEM students at WVU, MU and WVSU
- 80% of graduating doctoral students will have dissertation's published in refereed journals

Medium-Term Outcomes

- Increased practice of competitive research in molecular biometrics at the nanoscale level.
- Increased number of high quality grant proposal submissions
- Increased collaboration across disciplines, universities and entities (industry/education)
- Improved WV policies in support of research, technology and development
- Increased awareness of social action for support of gender, racial and ethnic diversity

Short-Term Outcomes

- Increased knowledge and findings in molecular research at the nano-scale level.
- Increased knowledge, skills, attitudes and motivations for grant-writing.
- Increased knowledge, skills, attitudes, and aspirations among UREP STEM students.
- Increased understanding of the infrastructure needed to support a diverse group of STEM students and interdisciplinary collaboration among a diverse group of research faculty.

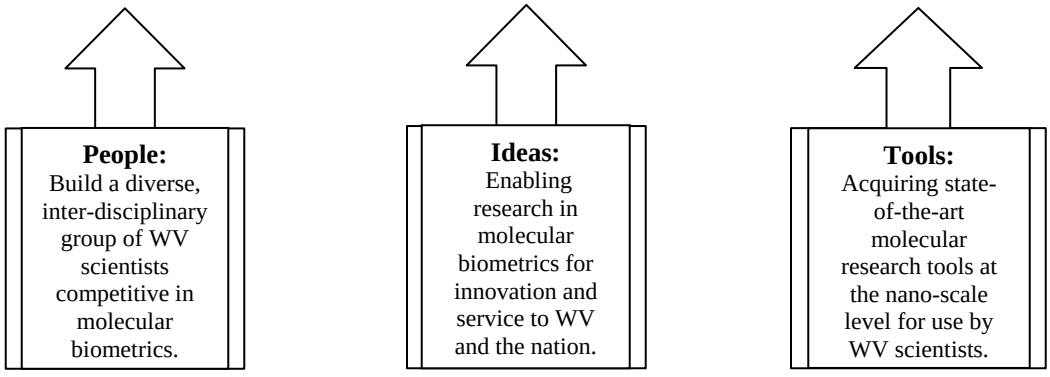
Outputs – Participation

- All levels of WVEPSCoR (Executive Leadership Team, External Advisory Board, etc.)
- Molecular research at the nano-scale level at MU and WVU with mentoring of WVSU faculty.
- Underrepresented STEM students at MU, WVU, WVSU, and FSU.
- Senior faculty as mentors of junior faculty
- Senior faculty, junior faculty and new hire researchers
- STEM Ph.D. Candidates and postdoctoral fellows as researchers

Inputs and Activities

- Hire 13 researchers who can meet the needs of the critical inter-disciplinary research groups.
- Develop the junior faculty by providing coordinated workshops, mentoring and technical assistance with clear expectations and performance measures.
- Provide competitive start-up funds using NSF and State funds to attract and retain a diverse group of nano-scale molecular biometrics researchers.
- Build capacity and competitiveness among senior faculty by acquiring tools specific to their research areas and provide grant-writing technical assistance.
- Build educational and industrial collaborations to support strong, sustainable progress in WV in S&T.
- Develop institutional capacity for supporting high-quality research grant writing and publications.
- Support diverse groups of undergraduate and graduate students and postdoctoral fellows to meet their unique educational needs by supporting them through bridge program, supplemental instruction, mentoring, research experiences and other coordinated development plans.
- Hire new faculty to strengthen Functional Building Block Groups and support current faculty for increased competitiveness of IGERT, NIRT and NER funding.
- Increase collaboration through management by ELT, ETAB and WVEPSCoR State Council.
- Mini-sabbaticals with RII thrust scientists for WVSU scientists to gain molecular biology/NSE knowledge and experience.

Goals



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Biographical Sketch: Paul L. Hill, Jr., Ph.D.

a. Professional Preparation

Marshall University	Zoology-Chemistry	B.S. 1976
Marshall University	Biological Sciences	M.S. 1978
University of Louisville	(Microbiology)	1980
University of Louisville	Biology- Systems Science	Ph.D. 1983

b. Appointments

2001-present:	Executive Director, NSF and West Virginia EPSCoR Program
1997-2000	Chairman & CEO, Member, US Chemical Safety Board (dual appointments)
1990-1997	President and CEO, National Institute for Chemical Studies
1988-1990	Vice-President and Project Director, National Institute for Chemical Studies
1988-1990	Adjunct Professor, Environmental Sciences, Graduate Program, University of Charleston
1987-1988	Assistant Administrator, West Virginia Department of Natural Resources
1983-1987	Science and Technical Advisor, West Virginia Water Resources Board
1979-1980	University of Louisville, Graduate Research Assistant

c. Publications

(i) **Five publications most closely related to proposal**.

Hill, P.L., Jr. et al..2001. WV Blueprint for Science and Technology: Strengthening Statewide Multidisciplinary Academic Research Infrastructure. National Science Foundation #0132740 Infrastructure Proposal. 84p.

Hill, P.L. Jr., R. Gillespie and F. Alendorf. 2004. Hawaii EPSCoR Monitoring and Assessment Panel (MAP): Report to the Management Team- HI EPSCoR Committee. External Site Visit Report. University of Hawaii, Honolulu, HI.

Hill, P.L., Jr. and J. Taylor. 2005. Research Strategies in Science, Engineering and Technology (ReSSET). National Science Foundation, #0527409 Planning Proposal 64p.

Arendt,S., and P.L. Hill, Jr. 1995. Technical Lessons Learned from Recent Regional Assessment Studies. Center for Chemical Process Safety, International Conference, New Orleans, LA. *Proceedings*.

Santos, S.L., P.L. Hill, Jr., and D. Gutenson. 1993. The Kanawha Valley Risk Communication Research Project: Lessons Learned. Focus Group, Inc, National Institute for Chemical Studies and USEPA. Society for Risk Analysis . Annual Conference *Proceedings*, Savannah, Ga. (abs.)

(ii) **Other publications**.

Hill, P.L., Jr., et. al., 1999. Year 2000 Issues: Technology and Industrial Chemical Safety, Report to the Senate Special Committee on the Year 2000 Technology Problem. USCSHIB Publication, Wash., D.C. 90p.

Bosserman, R.W., W.J. Mitsch, P.L. Hill, Jr., F.L. Smith and J. R. Taylor. 1981. Modelling and management of wetlands in the western coalfields of Kentucky in *Progress in Wetlands Utilization and Management*. Coordinating Council on the Kissimmee River Valley (Mcaffrey, Beemer and S.E. Gatewood, eds.) Tallahassee, FL.

Hill, P.L.Jr., J.R. Taylor and R.R. Ollis. 1991. West Virginia Discharge Reduction Scorecard . Pollution Reduction and Prevention in West Virginia Chemical Industry. National Institute for Chemical Studies, Research Publ., Charleston, WV. 187p.

Hill, P. L., Jr., et. al. 1998. Summary Report: Nitrogen Asphyxiaiton. Union Carbide Corporation Facility, Hahnville, LA. USCSHIB Publication Report No. 98-05-I-LA., Washington, D.C. 32p.

Hill, P.L., Jr., and J. R. Taylor. 1996. Transportation of Hazardous Materials in the Kanawha Valley of West Virginia. National Institute for Chemical Studies, Research Report, Charleston, WV. 89p.

d. Synergistic activities.

Reviewer, USEPA, NSF technical documents, proposals. Served on USEPA.s Advisory Committee on Implementation of the Clean Air Act Amendments of 1990. Member of National Association of State and Tribal Title III Program Officials; US Delegations to Organization for Economic and Community Development, Environmental Programme, Vienna, Austria .93 and Paris, France .96. Led effort to develop first consolidated U.S.electronic database for chemical accident information for research on causality and incidence. Youth science education volunteer. NSF Reviewer; EPSCoR Foundation; Hawaii EPSCoR State Committee; External Monitoring Panel.

e. Collaborators and Other Affiliations

Alendorf, F….University of Montana
Ardito, M....US EPA, San Francisco
Arendt, S.....JBF Associates
Atlas, R.M.....University of Louisville
Benson, K.B...University of Louisville
Bissett, L.....Nat.l. Inst. Chemical Std
Bosserman, R.L...University of Louisville
Conlon, P.J....US Chemical Safety Board
Cremeans. W. L..US Army COE, Marshall Univ
Daily, K.....University of Washington
Day, R. L.....University of Alaska
Etnier, D.R.....University of Tennessee
Gillespie, R….WV University
Gutenson, D.L.....USEPA, Washington, D.C
Haag, K.....University of Louisville
Hein-Silva, T...Contra Costa County, Ca.
Hornak, L….WV University
Horner, R....University of Washington
Jenski, L….Marshall University
Lovett, R.....West Virginia University
Mitsch, W.L....The Ohio State University
Ozkanak, H....Harvard University
Ollis, R.R.....Terradon Corporation
Palmer, D.L.....ERP&M, Inc.
Piatt, J.....Pacific Northwest Lab,
Rousch, M. B...Marshall University
Santos, S.L.....Columbia University,
Sawyer, R....Contra Costa County,CA .
Scott, M. ... Nat.l Inst. Chem. Studies
Smith, F.L.....University of Louisville
Sorenson, J.Oakridge National Lab,
Tarter, D.C...Marshall University
Taylor, J.R...Nat.l Inst. Chemical Std
Thompson, P.G...US Chem Safety
Treacy, D.H....WVDNR
Van Scoy, F…. WV University
Watkins, W.D..Marshall University
Walters, D...Pacific Northwest Lab
Wimmer, M. A..West Virginia Univ
Yu, B.A.....Los Angeles County Gov

(ii) Graduate and Postdoctoral Advisors

M.S. Advisor- Dr. Donald C. Tarter Marshall University
Ph.D. Advisor- Dr. Robert W. Bosserman University of Louisville
Post Grad. Sponsor- Dr. Ronald M. Atlas University of Louisville

(iii) Thesis Advisor and Postgraduate-Scholar Sponsor.

Robin R. Ollis (M.S. student)
Pamela L. Nixon (M.S. student)

Biographical Sketch: Howard Aulick, Ph.D.

(a) Professional Preparation

Undergraduate Institution(s)	Major	Degree	Year
College of William and Mary, Williamsburg, VA	Physical Education	A.B.	1962
Medical College of Virginia, Richmond, VA	Physical Therapy	B.S.	1964

Graduate Institution(s)	Major	Degree	Year
Indiana University, Bloomington, IN	Physiology	M.A., Ph.D.	1973-4

(b) Appointments

2004-Present	Vice President for Research, Marshall University, Huntington, WV
2004-Present	Interim Director, Institute for the Development of Entrepreneurial Advances, Marshall University, Huntington, WV
2001-2004	Interim Vice President for Research, Marshall University, Huntington, WV
1996-2004	Associate Dean for Research and Graduate Education, Joan C. Edwards School of Medicine, Huntington, WV
1992-1996	Assistant Dean for Research and Graduate Education, Joan C. Edwards School of Medicine, Huntington, WV
1989-1994	Vice Chairman, Physiology Department, Joan C. Edwards School of Medicine Huntington, WV
1990-Present	Professor, Physiology Department, Joan C. Edwards School of Medicine, Huntington, WV
1984-1990	Associate Professor, Physiology Department, Marshall University School of Medicine, Huntington, WV
1975-1984	Clinical Adjunct Assistant Professor of Surgery, Department of Surgery, Uniformed Service University of the Health Sciences, Department of Defense, Bethesda, MD
1975-1984	Research Scientist, U.S. Army Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, TX
1964-1970	Physical Therapist, Brooke Army Medical Center, Fort Sam Houston, TX (64-67), Second General Hospital, Landstuhl Medical Center, Landstuhl, Germany (67-70)

(c) Publications

Publications related to proposed project: None

Other significant publications:

Aulick, L.H., D.W. Wilmore, A.D. Mason, Jr. and B.A. Pruitt, Jr.: Influence of the burn wound on peripheral circulation in thermally injured patients. *Am. J. Physiol.* 233(4):H520-H526, 1977.

Aulick, L.H., S. Robinson and S.P. Tzankoff: Arm and leg intravascular temperatures of men during submaximal exercise. *J. Appl. Physiol.: Respirat. Environ. Exercise Physiol.* 51:1092-1097, 1981.

Strome, D.R., **L.H. Aulick**, A.D. Mason, Jr. and B.A. Pruitt, Jr.: Thermoregulatory and non-thermoregulatory heat production in the burned rat. *J. Appl. Physiol.* 61(2):688-693, 1986.

Aulick, L.H., F.A. Wroczynski, E. Madan and A.D. Mason, Jr.: Wound endotoxin is not a principal mediator of postburn hypermetabolism in the rat. *J. Trauma* 30:457-462, 1990.

Drost, A.C., B. Larson, and **L.H. Aulick**: The effects of thermal injury on serum interleukin-1 activity in rats. *Lymphokine and Cytokine Res.* 12(3):181-185, 1993.

(d) Synergistic Activity

State oversight of academic research/education programs

1. Member of WV EPSCoR State Committee, 1992 – Present
2. Member of the WV Science and Technology Council, 1996 - 2001
3. Co-Investigator, The West Virginia Biomedical Research Network, National Center for Research Resources, National Institutes of Health, 2001-2004, $5,675,423
4. Principal Investigator, Infrastructure Development in Cell and Molecular Science at Marshall University, WV Higher Education Policy Commission, 2001-2002, $133,000
5. Member of the Steering Committee, West Virginia Networks of Biomedical Research Excellence, National Center for Research Resources, National Institutes of Health, 2004-2009, $16,779,186

(e) Collaborations & Other Affiliation

Collaborators & Co-Editors:

1. Hill, Paul, Executive Director WV EPSCoR, Development of a West Virginia Science and Technology Strategic Plan – 2005-Present
2. Sheil, James, Co-PI on The West Virginia Biomedical Research Network, National Center for Research Resources, National Institutes of Health, 2001-2004, $5,675,423

Graduate and Postdoctoral Advisors:

1. Ph.D. Advisor: Robinson, S., Professor Emeritus, Indiana University, Bloomington, IN, deceased.
2. M.S. Thesis Advisor: same as above

Lawrence A. Hornak, Ph.D.

lah@csee.wvu.edu
voice: 304 293 0405
fax: 304 293 8602

A. Education

Rutgers University, Ph.D., Electrical Engineering (1991).
Stevens Institute of Technology, M.E. Electrical Engineering (1986).
Binghamton University (SUNY), B.S. Physics (1982).

B. Appointments

1982 to 1991: AT&T Bell Laboratories, Member of Technical Staff, Digital Optics Research Dept., Communications Systems Research Laboratory, Holmdel, NJ.

1991 to Present: Lane Dept. of Computer Science and Electrical Engineering, West Virginia University.

Positions/rank held:

Dec 2001 – present:	Director, NSF Ctr. for Identification Technol. Research (CITeR)
Jan. 1999 – Dec2002:	Research Director, CSEE
July 1997- Aug 1998:	Co-Interim Chair, Comp. Science and Electrical Eng. Dept.
July 1996 - June 1997:	Interim Chair, Electrical and Computer Engineering Dept.
Since Jan. 1996:	Director, Microelectronic Systems Research Center (MSRC)
1992 to 1996:	Associate Director, MSRC
Since 2001:	Professor
1994 to 2001:	Associate Professor
1991 to 1994:	Assistant Professor

B.1 Awards

* National Young Investigator, National Science Foundation (MIPS), 1992.
* 2001 WVU Foundation Outstanding Teacher, Golden Key Univ. Teaching Award, 1996/97.
* College of Engineering Outstanding Research 2003/04, Young Researcher Award, WVU 1992/1993
* AT&T Bell Laboratories Exceptional Contribution Awards, Through-Wafer Optical Interconnections 1987, High-Tc Superconducting Stripline 1989.

B.2 Recent Professional Activities

- General Co-Chair, Biometric Symposium, 2005 Biometric Consortium Conference.
- Program Comm., SPIE Micro-optio-electro-mechanical System (MOEMS) Conference, Santa Clara, CA 2001-2002.
- Originating Editor, IEEE Lasers and Electro-Optic Society World Wide Web Home Page 1995-2000.
- Editor, Polymers for Lightwave and Integrated Optics: Technology and Applications, Optical Engineering Book Series, Marcel Dekker, New York, NY. July 1992.
- Program Comm. & session chair, Optoelec. Interconnects, 1994-95,97-98 SPIE OE/LASE.
- Reviewer: NSF (EPDT, MIPS, ECS), IEEE Trans. Signal Processing, IEEE Comm. Magazine, IEEE Press, Appl. Optics, Marcel Dekker, IEEE Photonics Technol. Lett., IEEE Trans. on Electron Dev., IEEE Electron Dev.Lett., IEEE J. Sel. Areas in Comm., Innov. Systems in Silicon (ISIS) Conf, Electron Lett..

B.3 Funding History

PI or Co-PI for over $5.5M in externally funded projects (NSF, DoD, industry). Emphasis areas include: biometrics, MEMS, sensors and cointegration of emerging technologies (e.g. integrated optics, optoelectronics) within advanced microelectronic systems.

C. Publications

Over 90 book, journal, and conference publications including the following.

1. D. Lloyd, L Hornak, S Pathak, D Morton, and I. Stevenson; "Application of Ion Beam Assisted Thin Film Deposition Techniques to the Fabrication of a Biosensor Chip With Fieldability Potential for Biohazard Detection Applications" *47th Annual Technical Conference Proceedings, Soc. of Vac. Coaters,* ISSN 0737-5921 (2004).
2. J. Dawson, L. Wang, P. Famouri, L. A. Hornak, "Grating Enhanced Through-Wafer Optical Microprobe for MEMS High-Resolution Optical Position Feedback," *Optics Letters*, (2003).
3. J. Dawson, J. Chen, K. Brown, P. Famouri, and L. A. Hornak, "Through-wafer Optical Probe Characterization for MEMS Positional State Monitoring and Feedback Control," *Journal of Optical Engineering*, **39**(12), 3239-3246 (2000).
4. F. M. Dickey, S. C. Holswade, Hornak, and K. S. Brown, "Optical Methods for Micromachine Monitoring and Feedback," *Sensors and Actuators A,* **78** 220-235 (1999).
5. Hornak, "Polymer Integrated Optics: Enabling Technology for Micro-Electro-Mechanical Systems," invited paper *Proc SPIE*, Vol. 3008, pp. 124-35 (1997).

1. Derakhshani, S. A. C. Schuckers, L. A. Hornak, L. O'Gorman, "Determination of Vitality from a Non-Invasive Biomedical Measurement for use in Fingerprint Scanners," *Journal of Pattern Recognition, Special Issue on Biometrics*, **36**(2), 383-396, (2003).
2. K. S. Brown, B. Taylor, and Hornak, "Characterization of Poly (phenylsilsequioxane) Thin-film Planar Optical Waveguides*," Photonics Technol. Lett.*, **9**(6) 791 (1997).
3. S. K. Tewksbury, Hornak, H. E. Nariman, S. M. Langsjoen, N. J. Hall, J. J. Hall and S. P. McGinnis, "Cointegration of Optoelectronics and Submicron CMOS", *IEEE Trans. CHMT, Special issue on Wafer-Scale Integration*, **16**(7), 674-685 (1993).
4. Hornak and T. W. Weidman, "Propagation loss of index-imaged poly(cyclohexylsilyne) thin-film optical waveguides," *Appl. Phys. Lett.,* **62**(9) 913 (1993).

D.1 Synergistic Activities

1. Work collaboratively with industry, NRL and ONR to form a funded molecular biosensing effort.
2. Member of Nanoscience and Engineering Task Force determining interdisc. strategic plan for the university under charge from the Provost.
3. Collaboratively formed multiuniversity team and successfully established CITeR as an NSF I/UCRC.
4. Leads subset of interdisciplinary ID-Tech faculty team in NSF EPSCoR Infrastructure Project.
5. Led effort to develop first Biometric Systems Bachelor of Science Degree.

E.1 Recent Collaborators

Dr. Fred Dickey	Sandia National Labs	Dr. Anil Jain	MSU.
Dr. Parviz Famouri	EE/WVU	Dr. Aaron Timpeman	Chemistry/WVU
Mr. Donald Lloyd	Loats Assoc. Inc.	Dr. Stuart Tewksbury	Stevens Inst. of Tech.
Dr. Thomas Myers	Physics/WVU	Dr. Reza Gheffarian	NASA/JPL
Dr. S. Woodruff	NETL-DOE		

E.2 Graduate Advisor

Graduate advisor: Dr. B. Lalevic, Rutgers University. No postgraduate academic positions held.

E.3 Current and Former Graduate Students Supervised

Kolin Brown	Ph.D. 2000	WVU	Vijai Gandikota	MS 1998	Lucent
Carlo Dacunha	MS 2001	Univ AZ	Praveen Soora	MS 2001	Apple
Jeremy Dawson	Ph.D 2002	ISR			

CURT M. PETERSON
Associate Vice President for Research and Economic Development
WVU Research Corporation
West Virginia University
Morgantown, WV 26506

Education: Ph.D., Biology, University of Oregon, Eugene, OR, 1970
B.S., Biology, Moorhead State University, Moorhead, MN, 1966

Professional Experience:
Associate Vice President for Research and Economic Development, West Virginia University, 2005-
Interim Dean, College of Arts and Sciences, University of Northern Colorado, 2004-2005
Interim Associate Dean, College of Arts and Sciences, University of Northern Colorado, 2003-2004
Professor and Chair, Department of Biological Sciences, University of Northern Colorado, 1997-2003
Professor and Interim Coordinator, Plant Tissue Culture Facility, Auburn University, 1996-1997
Professor and Acting Head, Department of Botany and Microbiology, Auburn University, 1994-1996
Professor, Auburn University, 1984-1997; Associate Professor, Auburn University, 1976-1984
Plant Physiologist, USDA-ARS Experiment Station, Pendleton, OR, 1979-1980
Assistant Professor, Auburn University, 1971-1976

Administrative Responsibilities: Working with the WVNano Initiative, an interdisciplinary initiative in nanoscale science, engineering and education. WVU coordinator, Co-PI for WV EPSCoR; member WV EPSCoR Council.

Research Interests: Influence of abiotic stresses on plant growth/development; physiological and ultrastructural aspects of leaf/fruit abscission; development of online science courses to improve pedagogical content knowledge of in-service science teachers.

Publications: Published over 165 technical reports. Of this number, 53 articles published in refereed journals.

Grant/Contract Record: PI, Co-PI, or PD on extramural grants or contracts from NSF, USDA NRICGP, EPA EPSCOR Program, CO Commission on Higher Education, CO Department of Transportation, CO Department of Education, and other agencies totaling more than $2.8M.

M.S. and Ph.D. Students Supervised and Completed: 16; several hold professorial and/or administrative appointments in colleges/universities, community colleges, or as research scientists in government laboratories or medical schools.

Five Most Relevant Publications Involving Microscopy:
Peterson, C.M., L.Chen, R. Dute, and M.N. Kelley. 2003. Anatomical and ultrastructural observations of petiole abscission in cotton (*Gossypium hirsutum* L.). *Proc. 6th Multinational Congress on Microscopy – European Extension: 57-58.*

Mosjidis, C.O'H., C.M. Peterson, B. Truelove, and R.R. Dute. 1993. Stimulation of pod and ovule growth of soybean, *Glycine max* (L.) Merr. by 6-benzylaminopurine. *Ann. Bot*. 71:193-199.

Kuang, A., C.M. Peterson, and R.R. Dute. 1992. Leaf abscission in soybean: Cytochemical and ultrastructural changes following benzylaminopurine treatment. *J. Exp. Bot*. 43:1611-1619.

Dute, R. R., and C. M. Peterson. 1992. Early endosperm development in ovules of soybean. *Ann. Bot*. 69:263-271.

Oberholster, S. D., C. M. Peterson, and R. R. Dute. 1991. Pedicel abscission of soybean: Cytological and ultrastructural changes induced by auxin and ethephon. *J. Can. Bot*. 69:2177-2186.

Five Additional Publications Involving Microscopy:

Pritchard, S.G., C.M. Peterson, S.A. Prior, G.G. Runion, and H.H. Rogers. 1997. Effects of elevated CO_2, N fertility, and water status on the accumulation of ergastic substances in longleaf pine (*Pinus palustris* Mill.) foliage. *Trees: Structure and Function* 11:494-503.

Pritchard, S.G., H.H. Rogers, and C.M. Peterson. 1997. Elevated atmospheric CO_2 differentially affects needle chloroplast ultrastructure and phloem anatomy in *Pinus palustris*: Interactions with soil resource availability. *Plant, Cell and Environment* 20:461-471.

Sexton, P.J., K.J. Boote, J.W. White, and C.M. Peterson. 1997. Seed size and seed growth rate in relation to cotyledon cell volume and number in common bean. *Field Crops Research* 52:69-78.

Sexton, P.J., C.M. Peterson, K.J. Boote, and J.W. White. 1997. Early-season growth as a function of leaf photosynthetic traits in common bean. *Field Crops Research* 54:163-172.

S.G. Pritchard, S.A. Prior, H.H. Rogers, and C. M. Peterson. 2000. Description of previously undescribed calcium sulfate crystals associated with the stomatal cavity of container grown *Pinus palustris* (Pinaceae) foliage. *International Journal of Plant Sciences 16:917-923.*

Synergistic Activities:

- PI, grants from the CO Comm on Higher Ed and the CO Dept of Ed to develop online courses for an intercampus (Colorado State University and the University of Northern Colorado), interdisciplinary Master's of Natural Sciences degree for in-service teachers. The degree was approved at UNC when I left in February 2005 and was under review pending final approval at CSU.
- Participated in development of the NSF funded Center for Learning and Teaching in the West, ~ $10M, 2001-2005; a five-university collaborative (UNC, CSU, Montana State University, the University of Montana, and Portland State University). CLTW faculty member/director of CLTW related research projects/grants; attended/participated in annual meetings; supported the learning and teaching goals of the Center.
- PD, United Negro College Fund/Merck Development Award for a UNCF/Merck Undergraduate Science Scholarship Award, 2001-2002; the student currently is enrolled in graduate school at Yale University.
- Mentor/research director to: four talented/underrepresented precollegiate students, summers 2000-2002, UNC; talented/underrepresented HS biology students and teachers, Howard Hughes "Future Life Sciences Scholars Program", Auburn University, 1993-95; underrepresented HS student, EPA-EPSCoR High School Discovery Award, Auburn University, 1994.

Current Collaborators:

Tom. Chastain Angela Morrow Susan Hutchinson Jeff Farmer Christine Jones John Moore
Jodie Novak Tom Myers Lawrence Hornak Phyllis Barnhart Paul Hill

Dissertation Advisees:

L. Chen G. Hoogenboom A. Kuang R. Lartey S. Pritchard R. Shelby

Graduate Advisor: S. Tepfer

Biographical Sketch: Jan R. Taylor, Ph.D.

a. Professional Preparation

Marshall University	Biological & General Sciences	B.A.	1975
Marshall University	Biological Sciences	M.S.	1977
University of Louisville	Biology-Systems Science.	Ph.D.	1985

b. Appointments

2003-present	Deputy Director/Senior Research Fellow, West Virginia EPSCoR Program
1991-2003	Vice President and Projects Director, National Institute for Chemical Studies
1987-1991	Science and Technical Advisor, West Virginia Water Resources Board
1985-1987	Assistant Professor, Biological Sciences, Marshall University
1981-1985	University Research Fellow, University of Louisville
1981-1985	Project Investigator/Coordinator of Field Research, Energy and Ecological Systems Group, Systems Science Institute, University of Louisville
1977-1981	Senior Surveillance Specialist (Organics Detection System), Ohio River Valley Water Sanitation Commission (ORSANCO)

c. Publications

(i) **Five publications most closely related to proposal**.

Taylor, J.R. 2002. *Analysis of Hazardous Materials Transportation in the Kanawha Valley*. NICS Technical Publication, Charleston, WV.

Taylor, J.R. 2001. *Evaluation of Model Assumptions Used for the Alabama CSEPP Program*, U.S. Army, Soldier Biological and Chemical Command, Aberdeen, MD, DAAD13-01-P-0052 (http://www.csepp.army.mil/pub/bibliography/pdf/final_report_evaluation_assumptions.pdf).

Palmer, D. and J.R. Taylor. 2000. *Protective Action Decision-Making Training for Emergency Responders and Planners.* CD-based training course and manual. National Institute for Chemical Studies, Charleston, WV.

Taylor, J.R., et al. 1999. *Review of Chemical Accident Report –Shell Chemical Company, Deer Park, Texas,* NICS Technical Report, EPA Cooperative Agreement, Charleston, WV

Taylor, J.R., et al. 1999. *Review of Chemical Accident Report – Pennzoil Product Refinery, Rouseville, PA,* NICS Technical Report, EPA Cooperative Agreement, Charleston, WV.

(ii) **Other publications**.

Taylor, J.R. 1994-2003. *West Virginia Scorecard: Analysis of Toxic Release Inventory for West Virginia*. Annual publ. of the National Institute for Chemical Studies (NICS). Charleston, WV.

Hill, P.L., Jr., and J.R. Taylor. 1996. Transportation of Hazardous Materials in the Kanawha Valley of West Virginia. NICS Research Report, Charleston, WV. 89p.

Hill, P.L. Jr., J.R. Taylor and R.R. Ollis. 1991. West Virginia Discharge Reduction Scorecard . Pollution Reduction and Prevention in West Virginia Chemical Industry. NICS, Research Publ., Charleston, WV. 187p.

Mitsch, W.J., J.R. Taylor and K.B. Benson. 1991. *Estimating primary productivity of forested wetland communities in different hydrologic landscapes*. Landscape Ecology 5:75-92.

Taylor, J.R., M.A. Cardamone and W.J. Mitsch. 1990. Bottomland hardwood forests: their functions and values. In, J.G. Gosselink, L.C. Lee and T.A. Muir (eds.), Ecological *Processes and Cumulative Impacts: Illustrated by Bottomland Hardwood Wetland Ecosystems,* Chelsea, MI: Lewis Publ., Inc. pp. 13-86.

Mitsch, W.J., M.A. Cardamone, J.R. Taylor and P.L. Hill, Jr. 1985. Wetlands and water quality management in the eastern interior coal basin. In, R.P. Brooks, D.E. Samuel and J.B. Hill (eds.), *Wetlands and Water Management on Mined Lands,* University Park, PA: Penn State University Press. pp. 121-137.

Mitsch, W.J., J.R. Taylor, K.B. Benson and P.L. Hill, Jr. 1983. *Wetlands and coal surface mining in western Kentucky-a regional impact assessment*. Wetlands 3:161-179.

Mitsch, W.J., J.R. Taylor and K.B. Benson. 1983. Classification, modeling and management of wetlands-a case study in western Kentucky. In, W.K. Lauenroth, G.V. Skogerboe and M. Flug (eds.), *Analysis of Ecological Systems: State of the Art in Ecological Modelling,* Amsterdam: Elsevier. pp. 761-769.

Mitsch, W.J., J.W. Day, Jr., J.R. Taylor and L.C. Madden. 1982. *Models of North American freshwater wetlands.* Int. J. Ecol. Environ. Sci. 8:109-140.

Taylor, J.R., P.L. Hill, R.W. Bosserman and W.J. Mitsch. 1982. Ecosystem analysis of selected wetlands in the western Kentucky coalfield. In *Proceedings, Symposium on Wetlands in the Unglaciated Appalachian Region*. Morgantown, VA: West Virginia University Press. pp. 75-85.

Mitsch, W.J., J.W. Day, Jr., J.R. Taylor and C. Madden. 1982. Models of North American freshwater wetlands-a review. In, *Ecosystem Dynamics in Freshwater Wetlands and Shallow Water Bodies*, vol. 2. SCOPE and UNEP, Moscow, USSR. pp. 5-32.

d. Synergistic activities.

Reviewer, USEPA technical documents;.
Member of National Association of State and Tribal Title III Program Officials
Project Director for Licensed Remediation Specialist program
Member of Technical Working group for Protective Action implementation at chemical stockpile sites
Board of Directors,Kanawha Putnam Emergency Planning Committee

e. Collaborators and Other Affiliations

Ellison, K.	WV DEP	Scott, M.	NICS
Hill, P.L.	WVEPSCoR	Van Cantfort, C.	WPI
Palmer, D.L.	ERP&M, Inc.		

(ii) Graduate and Postdoctoral Advisors

M.S. Advisor	Dr. Dan K. Evans	Marshall University
Ph.D. Advisor	Dr. William J. Mitsch	University of Louisville

(iii) Thesis Advisor and Postgraduate-Scholar Sponsor.

David Hight (M.S. student)

Phyllis J. Barnhart
Interim WVNano Associate Director

Professional Preparation

West Virginia University	Curriculum and Instruction for Science Education - minor in Education Administration	Pursuing Doctorate
West Virginia University	Curriculum and Instruction for Higher Education - Physics and Chemistry	MA 1979
West Virginia University	Secondary Education Certification: Chemistry, Physics, General Science	BS 1972

Professional Positions

2004-Present	Interim Associate Director, WVNano, Research Office, West Virginia University
2003 - 2004	Science Education Consultant, AEL, Inc.; West Virginia University; Howard & Associates
2003 - 2004	Grant Consultant, West Liberty State College
1995 - 2002	Executive Director, Science/Project CATS, West Virginia Department of Education
1989 - 1995	Science Coordinator, West Virginia Department of Education
1988 - 1989	Teacher: Chemistry, Physics, Algebra, Kanawha County Schools, West Virginia
1980 - 1988	Instructor: Chemistry, Physical Science, Salem College, West Virginia
1973 - 1988	Teacher: Chemistry, Physics, Pleasants County Schools, West Virginia
1972 - 1973	Teacher: Chemistry, Physics, Taylor County Schools, West Virginia

Professional Leadership/Appointments

- Co-President, West Virginia Mathematics and Science Coalition (2004); Executive Director (1995-2004)
- Director, Council of State Science Supervisors Executive Board (2001-2003)
- Principal Investigator, Project CATS: Coordinated and Thematic Science (NSF ESI-9454425)
- Co-Principal Investigator, Coalfield Rural Systemic Initiative (NSF ESR-0135822)
- Co-Principal Investigator, Center for Rural Science and Mathematics Integration Development Grant (NSF ESI-0119731)
- Co-Principal Investigator, R. A. R. E. CATS: Radio Astronomy Research Experiences for Coordinated and Thematic Science (NSF ESI-9731498)
- Co-Principal Investigator, Earth Science in West Virginia for the 21st Century: RockCamp (NSF ESI-9155264)
- Management Team, Appalachian Rural Systemic Initiative (NSF OSR-9554465)
- Advisory Board, Teams of Interdisciplinary Graduate Fellows Engaged to Reinvigorate Students (TIGERS) to Science, Mathematics, Engineering and Technology (NSF DUE-9979523)
- Advisor, WV-Handle On Science (NSF ESI-9731412)
- External Review Board Member, West Virginia K-12 RuralNet (NSF ESI-9550017)
- NASA/CSSS Networking for Leadership, Inquiry and Systemic Thinking (1999-2003), Design Working Group (2002-2003)
- Committee Member, National Science Education Standards and Curriculum Development and Selection, National Research Council of the National Academy of Sciences (1996-97)
- Planning Committee Member, State Leadership Institute, National Research Council of the National Academy of Sciences
- Regional Board Member and State Leader, Eisenhower Regional Math/Science Consortium at AEL
- Executive Board Member, West Virginia Science Teachers Association (1989-2002)

Selected Publications

- Contributor, Blueprint for Change: Report from the National Conference on the Revolution in Earth and Space Science Education (TERC, 2002)
- Loucks-Horsley, S., Landes, N., Barnhart, P., Fitzgerald, T., Roth, K., Shiflett, R., & Tuomi, J. "The Transition to Standards-based Science Education: The Role of Professional Development", National Standards & the Science Curriculum: Challenges, Opportunities & Recommendations, pg. 131-137. (Kendall/Hunt Publishing Company, 2001)
- Edited and co-authored, West Virginia Science Content Standards and Objectives (WVDE, 2001)
- Edited and co-authored, Implementing West Virginia Instructional Goals and Objectives in Support of National Standards Workshop Manual (WVDE, 1997)
- Edited and co-authored, Project CATS Exemplar Training Module (WVDE, 1996)

Other Selected Publications

- Co-authored proposals garnering competitive funds including: RockCamp (NSF, 1991); Project CATS (NSF, 1994); WV: IMPACT (USDE, 1999); Reading for All (USDE, 1999); Project MERIT (NSF, 2000); Center for Rural Science and Mathematics Integration Development Grant (NSF, 2001); Coalfield Rural Systemic Initiative Development Grant (NSF, 2000); Coalfield Rural Systemic Initiative (NSF, 2001)
- Authored, West Virginia Competitive Grants for Instructional Improvement Program Policy and Guidelines (WVDE, 1989, 1990, 1991, 1992)
- Co-authored, West Virginia Science Curriculum Framework "Understanding the Goals" Workshop Manual (WVDE, 1993)
- Edited and co-authored, West Virginia Curriculum Framework (WVDE, 1992)
- Co-authored, A Teacher's Guide to Grants and Programs (WV Humanities Council, 1991)

Science Education and Assessment Synergistic Activities

- Contributor and State Project Director, State Collaborative on Assessment and Student Standards (SCASS) Science Project (CCSSO, 1992-2002)
- Contributor and State Project Director, Survey of Enacted Curriculum for Science Project (CCSSO, 1997-2002)
- Contributor, SCASS Science Assessment Resource CD-ROM (CCSSO, 2001)
- Item Reviewer, National Assessment of Educational Progress - Science (1993, 2000)
- Item Reviewer, SCASS Science Assessment (ACT, 1993-1998)
- Contributor, SCASS Science Assessment Measures of Enacted Curriculum (CCSSO, 1996, 1997)
- Contributor, SCASS Portfolio to Explore Science (CCSSO, 1996)
- Contributor, West Virginia Content Specialization Test for Physics (National Evaluation Systems, 1987)

Collaborations Outside of West Virginia

- National Panel, South Carolina Education Oversight Committee (2002)
- Invited Presenter/Consultant, Education Service Unit #6, Nebraska (2001)
- Invited Panelist, Integrated Science (BSCS), NSTA 2000 National Convention – Orlando
- Invited Panelist, Regional Systemic Reform, NSTA 1997 Area Convention – Nashville
- Selected Presenter, NSTA National Conventions (1996, 1997, 1998, 2000, 2003)
- Invited Presenter, Delaware Science Teachers Conference (1996)
- Invited Presenter, Texas Collaboratives for Excellence in Science Teaching (1995, 1996)
- Invited Panelist, National Standards, NSSA-NSTA Mini-Conference - Louisville (1993)
- Selected Presenter, NSTA Regional Conventions (1992, 1993, 1995, 1997)

Biographical Sketch: Eric R. Blough, Ph.D.

(a) Professional Preparation

Michigan Technological University, MI	B.S. (Biology)	1990
Southern Illinois University, IL	M.S. (Exercise Physiology)	1992
The Ohio State University, OH	Ph.D. (Exercise Physiology)	1997
University of Illinois at Chicago Medical School, IL	Post-doctoral Fellow	1999

(b) Appointments

Michigan Technological University, Houghton, MI, Adjunct Assistant Professor, 2003 to present

Marshall University, Huntington, WV, Assistant Professor, Department of Biological Sciences, 2003 to present

Joan C. Edward's School of Medicine, Marshall University, Huntington, WV, Assistant Professor of Physiology, Joint Appointment, 2003 to present

Michigan Technological University, Houghton, MI, Visiting Assistant Professor, Department of Biological Sciences, 2002-2003

Michigan Technological University, Houghton, MI, Instructor/Laboratory Supervisor, Departments of Biomedical Engineering and Biological Sciences, 2001-2002

Michigan Technological University, Houghton, MI, Laboratory Supervisor, Department of Biological Sciences, 2000-2001

(c) Publications

Publications related to proposed project:

Kinnard, R.S., Mylabathula, D.B., Uddemarri, S., Rice, K.M., Wright, G.L., and Blough, E.R. Aging effects the expression of muscle phenotype regulators differently in fast- and slow-twitch skeletal muscles (In press: Biogerontology).

Rice KM, Kinnard RS, Harris R, Wright GL, and Blough ER. Effects of aging on pressure-induced MAPK activation in the rat aorta. Pflugers Arch. 2005 May 5;

Linderman, J. K., and E. R. Blough. Aging does not attenuate plantaris muscle hypertrophy in male Fischer 344 rats. Med Sci Sports Exerc. Jul;34(7):1115-9, 2002.

Ludwig, Lauren, R. Enz, D. Nelson, and E. R. Blough. Method of Determining the role of heat shock proteins in preventing tendon disuse atrophy in rats. Proceedings of the Society of Experimental and Mechanical Engineering. Vol. 1, No. 2., 2002.

Blough E. R., J. K. Linderman. Lack of skeletal muscle hypertrophy in very aged male Fischer 344 x Brown Norway rats. Journal of Applied Physiology. Apr;88(4):1265-70, 2000.

Other significant publications:

Esser, K., T. Nelson, V. Lupa-Kimball and E. R. Blough. The CACC box and myocyte enhancer factor-2 sites within the myosin light chain 2 slow promoter cooperate in regulating nerve-specific transcription in skeletal muscle. The Journal of Biological Chemistry. Vol. 274, No. 17, 12095-12102, 1999.

Baar, K., E. R. Blough, B. Dineen and K. A. Esser. Transcriptional regulation in response to exercise. Exercise and Sport Sciences Reviews. Vol. 27 P. 333-379, 1999.

Mulroy S, E. R. Blough, E. K. Mehta, M. Myhal, and J. K. Linderman. E ffects of gender and functional overload on plantaris muscle morphology in the dwarf(HsdOla:dw-4) Lewis rat. Life Sciences. 65(23):2489-96, 1999.

Blough, E. R. and K. A. Esser. The CACC box and MEF-2 sites regulate nerve-specific transcription of the myosin light chain 2 slow promoter. Muscle satellite cell workshop- Growth, Regeneration and Muscle Disease. Vol. 1, No. 1, 1999.

Blough, E. R., B. Dineen and K. A. Esser. Extraction of nuclear proteins from striated muscle tissue. Biotechniques. 26:202-206, 1999.

(d) Synergistic Activity

1.) Participate as a mentor in Marshall SURF program. Currently advise (2) female undergraduates

2.) Co-investigator on a NIH INBRE grant. Will serve as mentor person for undergraduate students from a

West Virginia State College (Minority institution in West Virginia)

3.) Serve as Science fair judge, West Virginia High School competition

4.) Adjunct appointment: Biomedical Engineering Department, Michigan Technological University
Joint appointment: Department of Physiology, Joan C. Edwards School of Medicine

5.) Past participant NASA Space Grant consortium: have mentored 3 promising undergraduate students for summer research.

(e) Collaborations & Other Affiliation

Collaborators:

Tammy Haut Donahue, Ph.D., Ass't Professor, Michigan Technological University, Houghton, MI
Seth Donahue, Ph.D., Ass't Professor, Michigan Technological University, Houghton, MI
Robert Harris, Ph.D. Assoc. Professor, West Virginia State College
David Nelson, Ph.D. Professor, Michigan Technological University, Houghton, MI
Gary Wright, Ph.D., Professor, Marshall University School of Medicine

Graduate and Postdoctoral Advisors: NONE

Thesis Advisor and Postgraduate-Scholar Sponsor:

Graduate students: (3) Zihao Wang, Ajay Sundaram, Bob Efiler, Robert Putt
Postgraduate-Scholar Sponsor: None

Biographical Sketch - Richard Lloyd Carroll

I. Professional Preparation

B. S., Science Education, North Carolina State University, 1991
Ph. D. Chemistry, Inorganic Chemistry, North Carolina State University, 2001
Research Associate, UNC–Chapel Hill, Dept. of Physics and Astronomy, 2001 - 2005

II. Appointments

Assistant Professor	*Chemistry, West Virginia University*	2005
Secondary School Science Instructor	*Northern Vance High School, Vance Co., NC*	1992 - 1995

III. Publications

A. Related Publications

Chemically Well-Defined Lithography Using Self-Assembled Monolayers And Scanning Tunneling Microscopy In Nonpolar Organothiol Solutions. C. B. Gorman, R. L. Carroll, Y. F. He, F. Tian, R. Fuierer, *Langmuir* **2000**, *16*, 6312-6316.

Patterning Mesoscale Gradient Structures with Self-Assembled Monolayers and Scanning Tunneling Microscopy Based Replacement Lithography. R. R. Fuierer, R. L. Carroll, D. L. Feldheim, and C. B. Gorman, *Advanced Materials*, **2002**, *14*, 154-157.

Two-Dimensional Manipulation and Orientation of Actin-Myosin Systems With Dielectrophoresis. S. B. Asokan, L. M. Jawerth, R. L. Carroll, R. E. Cheney, S. Washburn, R. Superfine, *Nanoletters,* **2002**, *3*, 431-437.

Ligament Cells Stretch-Adapted On A Microgrooved Substrate Increase Intercellular Communication In Response To A Mechanical Stimulus. B. F. Jones, M. E. Wall, R. L. Carroll, S. Washburn, A. J. Banes, *Journal of Biomechanics*, **2005**, *38*, 1653-1664.

Flow Induced Forces On Molecular Motor Motility. S. B. Asokan, R. L. Carroll, R. E. Cheney, S. Washburn, R. Superfine, Submitted for Publication, *Proceedings of the National Academy of Sciences,* **2005**.

B. Other Significant Publications

Negative Differential Resistance in Patterned, Electroactive Self-Assembled Monolayers. C. B. Gorman, R. L. Carroll, R. Fuierer, *Langmuir*, **2001**, *17*, 6923-6930.

The Influence of Head Group on the Structure of Self-Assembled Monolayers as Viewed by Scanning Tunneling Microscopy. C. B. Gorman, Y. F. He, R. L. Carroll, *Langmuir*, **2001**, *17*, 5324-5328.

Nanoparticle Layers Assembled Through DNA Hybridization: Characterization and Optimization. M. L. Sauthier, R. L. Carroll, C. B. Gorman, S. Franzen, *Langmuir,* **2002**, *18*, 1825-1830.

The Genesis of Molecular Electronics. R. L. Carroll, C. B. Gorman, *Angewandte Chemie International Edition*, **2002**, *41*, 4378-4400.

IV. Synergistic Activities

- Referee for *Biophysical Journal*
- Strong mentoring activities at UNC, particularly for under-represented minorities through the SPGRE and SMART programs; 10 students mentored: 2002 – 2005
- Inaugural recipient of North Carolina Teaching Fellows Scholarship, 1987

V. Collaborators and Other Affilliations

A. Collaborators and Co-editors

S. B. Asokan, UNC-CH; A. J. Banes, UNC-CH; R. E. Cheney, UNC-CH; B. F. Jones, UNC-CH; R. Superfine, UNC-CH; M. E. Wall, UNC-CH; S. Washburn, UNC-CH.

B. Graduate and Post-Doctoral Advisors

Graduate Advisor: C. B. Gorman, Chemistry, North Carolina State University
Postdoctoral Advisor: R. Superfine, Physics and Astronomy, University of North Carolina – Chapel Hill

C. Thesis Advisor and Postgraduate Scholar Sponsor

None as yet

Boyd F. Edwards

INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(S)	FIELD OF STUDY
Utah State University, Logan, Utah	B. S.	1980	Physics
Utah State University, Logan, Utah	M. S.	1983	Physics
Stanford University, Stanford, California	Ph. D.	1985	Applied Physics
Sandia National Laboratories, Livermore, California	Postdoctoral	1985-1986	Applied Physics

EXPERIENCE: Postdoctoral Research Associate, Combustion Research Facility, Sandia National Laboratories, Livermore, California, 2/85 – 8/86; Assistant Professor, 8/86 – 8/91, Associate Professor, 8/91 – 8/96, Professor, 8/96 – , West Virginia University, Morgantown, West Virginia; National Research Council Senior Research Associate, National Energy Technology Laboratory, Morgantown, West Virginia (2000-2001, while sabbatical leave from West Virginia University).

HONORS AND AWARDS: Sigma Pi Sigma physics honor society, 1979; Phi Kappa Phi academic honor society, 1980; Graduated magna cum laude at Utah State University, 1980; Utah State University Graduate Fellowship, 1981; Concertmaster, Utah State University Symphony Orchestra, 1979-81; Co-concertmaster, Stanford Summer Orchestra, 1982; Coauthor of ConcertWare software for Macintosh (winner of 1985 MacUser magazine Editor's Choice Award, 1987 A+ magazine Reader's Choice Award, and 1987 MacWorld magazine World Class Award for best music software, 22,000 copies sold), West Virginia University College of Arts and Sciences Outstanding Teacher Award, 1992; West Virginia University Foundation Outstanding Teacher Award, 1992; U. S. Patent #5823533 for "Puzzle in Two and Three Dimensions," 1998; June Harless Award for Exceptional Teaching, 1998; National Research Council Senior Research Associateship Award, 2000-01.

SELECTED PUBLICATIONS: (43 research papers published):

"Onset of Convection for Autocatalytic Reaction Fronts: Laterally Unbounded System," B. F. Edwards, J. W. Wilder, and K. Showalter, Phys. Rev. A **43**, 749 (1991).

"General Solutions and Scaling Violation for Fragmentation with Mass Loss," J. Huang, B. F. Edwards, and A. D. Levine, J. Phys. A. **24**, 3967 (1991).

"Finite Thermal Diffusivity at Onset of Convection in Autocatalytic Systems: Continuous Fluid Density," J. W. Wilder, B. F. Edwards, and D. A. Vasquez, Phys. Rev. A **45**, 2320 (1992).

"Fragmentation of Percolation Clusters at the Percolation Threshold," M. F. Gyure and B. F. Edwards, Phys. Rev. Lett., **68**, 2692 (1992).

"Convective Instability of Autocatalytic Reaction Fronts in Vertical Cylinders," D. A. Vasquez, J. W. Wilder, and B. F. Edwards, Phys. Fluids A **4**, 2410 (1992).

"Hydrodynamic instability of chemical waves," D. A. Vasquez, J. W. Wilder, and B. F. Edwards, J. Chem. Phys. **98**, 2138 (1993).

"Convective Turing Patterns," D. A. Vasquez, J. W. Wilder, and B. F. Edwards, Phys. Rev. Lett. **71**, 1538 (1993).

"Onset of convection for autocatalytic reaction fronts in a vertical slab," J. Huang, D. A. Vasquez, B. F. Edwards, and P. Kolodner, Phys. Rev. E **48**, 4378 (1993).

"Derivation of a nonlinear front evolution equation for chemical waves involving convection," J. W. Wilder, B. F. Edwards, D. A. Vasquez, and G. I. Sivashinsky, Physica D **73**, 217 (1994).

"Convection in Chemical Waves," D. A. Vasquez, J. M. Littley, J. W. Wilder, and B. F. Edwards, Phys. Rev. E **50**, 280 (1994).

"Nonaxisymmetric and axisymmetric convection in propagating reaction-diffusion fronts," J. Masere, D. A. Vasquez, B. F. Edwards, J. W. Wilder, and K. Showalter, J. Phys. Chem. **98**, 6505 (1994).

"Convective Chemical-wave Propagation in the Belousov-Zhabotinsky Reaction," Y. Wu, D. A. Vasquez, B. F. Edwards, and J. W. Wilder, Phys. Rev. E, **51**, 1119 (1995).

"Finite thermal diffusivity at onset of convection in autocatalytic systems: Discontinuous fluid density," D. A. Vasquez, B. F. Edwards, and J. W. Wilder, Phys. Fluids **7**, 2513 (1995).

"Transitions between convective patterns in chemical fronts," Y. Wu, D. A. Vasquez, B. F. Edwards, and J. W. Wilder, Phys. Rev. E **52**, 6175 (1995).

"Chemical wave propagation in Hele-Shaw cells and porous media," D. A. Vasquez, J. W. Wilder, and B. F. Edwards, J. Chem. Phys. **104**, 9926 (1996).

"Pattern formation and evolution near autocatalytic reaction fronts in a narrow vertical slab," J. Huang and B. F. Edwards, Phys. Rev. E. **54**, 2620 (1996).

"Thermoconvective instability of paramagnetic fluids in a uniform magnetic field," J. Huang, B. F. Edwards, and D. D. Gray, Phys. Fluids **9**, 1819 (1997).

"Nonlinear front evolution of hydrodynamic chemical waves in vertical cylinders," J. W. Wilder, D. A. Vasquez, and B. F. Edwards, Phys. Rev. E **56**, 3016 (1997).

"Magnetic control of convection in nonconducting diamagnetic fluids," J. Huang, D. D. Gray, and B. F. Edwards, Phys. Rev. E **58**, 5164 (1998).

"Thermoconvective instability of paramagnetic fluids in a nonuniform magnetic field," J. Huang, D. D. Gray, and B. F. Edwards, Phys. Rev. E **57**, 5564 (1998).

"Dynamics of falling raindrops," B. F. Edwards, J. W. Wilder, and E. E. Scime, Euro. J. Phys. **22**, 113 (2001).

"Two-dimensional magnetothermal plumes," D. D. Gray, J. Huang, and B. F. Edwards, Int. J. Engr. Sci., **37**, 1937 (2001).

"Critical wavelength for river meandering," B. F. Edwards and D. H. Smith, Phys. Rev. E Rapid Comm. **63**, 045304 (2001).

"River meandering dynamics," B. F. Edwards and D. H. Smith, Phys. Rev. E **65**, 046303 (2002).

"Poiseuille advection of chemical reaction fronts," B. F. Edwards, Phys. Rev. Lett. **89**, 104501 (2002).

"Influence of terrain on scaling laws for river networks," D. A. Vasquez, D. H. Smith, and B. F. Edwards, Water Resources Research, **38** No. 11, 10.1029/2000WR000152 (2002).

"Did chiasmus appear in the Book of Mormon by chance?" B. F. Edwards and W. F. Edwards, BYU Studies, **43**, No. 2, 103 (2004).

GRANTS ($916,148 in total funding)

"Ash mass distributions during coal char oxidation and fragmentation," cofunded by the EWRC ($55,000) and the NSF Pittsburgh Supercomputing Center (1987-89).

"Convection in Autocatalytic Systems," West Virginia University Energy and Water Research Center (EWRC) project number CB 3-91(1,2,3), $48,000 with J. Wilder (1990-93).

"Buoyancy-Driven Convection for Propagating Reaction Fronts," NSF EPSCoR phase II grant number RII-8922106 with state matching; $115,072 (1991-93).

"Mineral Transformations and Fragmentation in Coal Combustion," cofunded by the U. S. Department of Energy grant number DE FG22-89PC89791, $199,979, and the National Research Center for Coal and Energy, $64,263 (1989-95).

"Buoyancy-Driven Convection for Propagating Reaction Fronts," NSF EPSCoR phase III grant number OSR-9255224 with state matching; $154,536 (1993-96).

"Magnetothermal Convection in Nonconducting Diamagnetic and Paramagnetic Fluids," NASA Microgravity Science and Applications Division grant number NAG3-1921, $250,000 with D. Gray (1996-98).

"Convective stability of advected chemical waves: model development," NASA West Virginia Space Grant Consortium, $24,298 (2003).

"Summer Integrative Mathematics & Science Project," Eric Pyle, Mike Long, and Boyd Edwards; West Virginia Improving Teacher Quality State Grants Program $50,676, $5000 Edwards share (2003-2004).

POSTDOCS SUPPORTED:

Jie Huang, Magnetothermal Convection (1996-1998)
Jie Huang, Convection near Reaction Fronts (1994-96).
Siegfried Bleher, Hard-disk models of Propagating Fronts (1993-1995).
Eugenia Kuo, Convection near Reaction Fronts (1994).
Desiderio Vasquez, Convection near Reaction Fronts (1990-93).
Mark Gyure, Fragmentation of Percolation Clusters (1990-91).
Mao Cai, Rate Equations for Fragmentation (1987-89).

Parviz Famouri

pfamouri@wvu.edu voice: 304 293 6371 x 2530 fax: 304 293 8602

a. Professional Preparation

Ph.D. Electrical Engineering May 1990, University of Kentucky

MS Electrical Engineering May 1986, University of Kentucky

BS Electrical Engineering August 1982, University of Kentucky

BS Applied Mathematics May 1981, Kentucky State University

b. Appointments

May 2002 - present - Professor, Lane Department of Computer Science & Electrical Engineering, West Virginia University, Morgantown, WV.

Aug. 1996 - present - Associate Professor, Computer Science & Electrical Engineering, West Virginia University, Morgantown, WV.

Aug. 1992 - present - Director of Electro-Mechanical Systems (EMS) Laboratory in the Department of Computer Science & Electrical Engineering, West Virginia University, Morgantown, WV.

Aug. 1990 – May 1996 - Assistant Professor, Electrical & Computer Engineering, West Virginia University, Morgantown, WV.

May 1994 - August 1994 - Research Scientist, Emerson Motor Technology Center, St. Louis, MO

Jan. 1986 - May 1990 - Research Assistant, Electrical Engineering Department, University of Kentucky, Lexington, KY.

Jan. 1979 - August 1981 - Assistant Operator in Computing Center at Kentucky State University, Frankfort, KY.

Awards

- 2002 College of Engineering & Mineral Resources Outstanding Research Award
- Recipient of the IEEE Third Millennium Medal by the IEEE
- 1997 Department of Electrical & Computer Engineering Outstanding Service Award
- 1996 Department of Electrical & Computer Engineering Outstanding Research Award

Funding History

PI or Co-PI for over $4M in externally funded projects (NSF, DoD, NASA, DOE). Emphasis areas include: Micro electromechanical systems and electromagnetism.

c. Publications

Related

- J. M. Dawson, L. Wang, P. Famouri, and L. A. Hornak, "Grating-Enhanced Through-Wafer Optical Microprobe for MEMS High-Resolution Optical Position Feedback," under press Optics Letters, 2003.
- J. M. Dawson, J. Chen, K. S. Brown, P. Famouri, and L. A. Hornak , "*Through-Wafer interrogation of Microstructure Motion for MEMS Feedback Control*," the SPIE Journal of Optical Engineering, vol. 39, no. 12, pp 3239-3246, December 2000.
- J. Park, L. Wang, J. Dawson, L. Hornak, and P. Famouri, "Microstructure State Estimation Using MEMS Optical Monitoring," *invited paper*, IEEE Sensors2002 - June 12-14, 2002 - Orlando, Florida. Nominated for the Best Conference Paper Award.

- L. A. Hornak, P. Famouri, J. Dawson and L. Wang, "MOEMS Integrated Optical Monitoring," *invited paper*, MOEMS and Miniaturized Systems, proc. SPIE, vol. 4561, San Francisco, CA, October 22-24, 2001.
- J. Dawson, L. Wang, J. Chen, P. Famouri and L. Hornak, "*MEMS Feedback Control Using Through-Wafer Optical Device Monitoring*," proceeding of *the SPIE, MOEMS and Miniaturized Systems*, Santa Clara, California, pp. 221-231, September 18-20, 2000.

<u>*Closely Related*</u>

- L. Wang, J. M. Dawson, J. Chen, P. Famouri and L. Hornak, "*Stroke-length Control of a MEMS Device*," the 2000 IEEE International Symposium on Industrial Electronics Society, pp. 535-539, Puebla, Mexico, December 4-8, 2000.
- Jingdong Chen, Parviz Famouri and Lawrence Hornak, "Nonlinear Control of MEMS: Microengine Sliding Control Simulation," in *Proc. International Conference on Intelligent Systems and Control,* Santa Barbara, California, pp. 96-101, October 28-30, 1999.
- J. M. Dawson, J. Chen, K. S. Brown, P. Famouri, and L. A. Hornak , "*Through-Wafer integration of Microstructure Motion for MEMS Feedback Control*," the SPIE Journal of Optical Engineering, vol. 39, no. 12, pp 3239-3246, December 2000.
- J. Dawson, L. Wang, J. Chen, P. Famouri and L. Hornak, "*MEMS Feedback Control Using Through-Wafer Optical Device Monitoring*," proceeding of *the SPIE, MOEMS and Miniaturized Systems*, Santa Clara, California, pp. 221-231, September 18-20, 2000.
- J. Dawson, J. Chen, P. Famouri and L. Hornak, "Through-Wafer Integration of Microstructure Motion for MEMS Feedback Control," proceeding of *the SPIE, Miniaturized Systems with Micro-Optics and MEMS*, Santa Clara, California, pp. 281-292, September 20-22, 1999.

d. Collaborators & Other Affiliations

(i) Collaborators

Dr. R. Ghaffarian	Jet Propulsion Laboratories	Dr. Larry Hornak	WVU
Dr. Alice Lee	Johnson Space Flight Center	Edward Boyle	DOE/NETL
Dr. Kazuhiro Kohama	Gunma University School of Medicine, Japan	Peter Gannett	WVU

(ii) Graduate and Postdoctoral Advisors

Jeremy Dawson	Post-doc	WVU	Jingdon Chen	Ph.D. 2001	
Juchil Park	Ph.D. student	WVU	William Cawthorne	Ph.D. 1999	
H. Shim	MS student	WVU	D. Rerkpreedapong	MS 1999	
Limin Wang	Ph.D. student	WVU	Hokyung Hwang	PhD 1997	
Gang Wang	MS student	WVU	Junji Matsamoto	MS 1997	
Hasan Mohammad	Ph.D. student	WVU	Sharon Clark	MS 1996	
Scott Rittenhouse	M.S. student	WVU	Jing Wang	MS 1995	

(iii) Thesis Advisor and Postgraduate-Scholar Sponsor

Graduate advisor: Dr. Jim Cathey, University of Kentucky.

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Daniel C. Flynn, PhD	Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
University of Maryland, College Park, MD	BS	1981	Microbiology
North Carolina State University, Raleigh, NC	PhD	1988	Virology
University of Virginia, Charlottesville, VA	Post-Doc	1992	Oncogenes

Research and Professional Experience:

1992-1998. Assistant Professor, Mary Babb Randolph Cancer Center and the Dept. of Microbiology & Immunology, West Virginia University.
1998-2003. Associate Professor, Mary Babb Randolph Cancer Center and the Dept. of Microbiology & Immunology, West Virginia University.
2000-present. Associate Director for Basic Research, Mary Babb Randolph Cancer Center, West Virginia University, Morgantown, WV 26506-9300
2001-2006 Director, Center of Biomedical Research Excellence (CoBRE) in Signal Transduction and Cancer
2003-present. Professor, Mary Babb Randolph Cancer Center and the Dept. of Microbiology & Immunology, West Virginia University.
2003-present Director, Graduate training and research program in Cancer Cell Biology, West Virginia University.

Honors, Membership on Advisory Committees

1977-1981 - Senatorial Scholarship, University of Maryland, College Park.
1989-1992 - NIH post-doctoral training fellowship, University of Virginia, Charlottesville.
1993, 1999 - Faculty Development Award, West Virginia University
1994 - Veterans Administration, Oncology Study Section, Ad Hoc member.
1995, 1996, 1998 - USDA Cell Biology Study Section, mail in reviewer
1995 - Awarded "Blue Ribbon" for Outstanding Presentation in Signal Transduction; 86th annual meeting of the American Association for Cancer Research; Toronto, Ontario, Canada.
2001 - Dean's Award for Excellence in Research - West Virginia University School of Medicine
2001 - Guest Editor, *Oncogene* special edition on Adaptor Proteins
2001-2003 – NIH/CSR Study Section (CAMP), full member
2003-2004 – NIH/CSR Study section (TME), full member.
2004-2005 – Ad hoc study CSR study section member (TME, TCB).
2005 Percival L. MacLachlan Award for Excellence in Teaching of Medical Students.
2005 Co-organizer, 9th Annual meeting on biological therapies and translational research for cancer. Pittsburgh, PA, Feb 16-18, 2006
2005 Member, "Working group to promote Phase I/IIa clinical trials among cancer center consortia".

Publications over the last 4 years (of 46 total publications):

1. Baker, S.J., R. Sumerson, C.D. Reddy, AS Berrebi, **D.C. Flynn** and E.P. Reddy. 2001. Characterization of an Alternatively spliced AATYK mRNA: Expression pattern of AATYK in the brain and neuronal cells. *Oncogene 20:1015-1021*.
2. Qian, Y, S. Wang, S.S. Leonard, J. Ye, F. Chen X. Shi and **D.C. Flynn**. 2001. Cr(VI) causes the increase of tyrosine phosphroyation through reactive oxygen species-mediated reactions. *Mol. Cell. Biochem*. 222:199-204.
3. **Flynn D.C**. 2001. Adaptor Proteins. *Oncogene* 20:6270-6272.
4. Baisden, J.M., Y. Qian, H.G. Zot and **D.C. Flynn**. 2001. The actin filament associated protein AFAP-110 is an adaptor protein that modulates changes in actin filament integrity. *Oncogene* 20: 6435-6447.
5. Baisden, J.M., A.S. Gatesman, L. Cherezova, B.-H. Jiang, and **D.C. Flynn**. 2001. The intrinsic ability of AFAP-110 to alter actin filament integrity is linked with its ability to also activate cellular tyrosine kinases. *Oncogene* 20:6607-6616.
6. Cherezova, L., A. Gatesman and **D.C. Flynn**. 2002. Regulation of Adaptor protein function through phosphorylation. *Frontiers in Bioscience* 7: 164-203.
7. Qian Y., J.M. Baisden, L. Cherezova, X. Shi, T. Mast, J. Pustula, H.G. Zot N. Mazloum, M.Y. Lee, and **D.C. Flynn**. 2002. PKC phosphorylation increases the ability of AFAP-110 to cross-link F-actin. *Mol. Biol. Cell.* 13(7):2311-2322.
8. Gao N., B.H. Jiang, S.S. Leonard, L. Corum, Z. Zhang, J.R. Roberts, J. Antonini, J.Z. Zheng, **D.C. Flynn**, V. Castranova, X. Shi. 2002. p38 signaling-mediated hypoxia-inducible factor 1alpha and vascular endothelial growth factor induction by Cr(VI) in DU145 human prostate carcinoma cells. *J Biol Chem* 277:45041-45048.

9. Berwanger B., O. Hartmann, E. Bergmann, S. Bernard, D. Nielsen, M. Krause, A. Kartal, **D. Flynn**, R. Wiedemeyer, M. Schwab, H. Schäfer, H. Christiansen and M. Eilers. 2002. Loss of a Fyn-regulated differentiation and growth arrest pathway in advanced stage neuroblastoma. *Cancer Cell,* 2(5):377-386.
10. Summy J.M., M. Sudol, M. Eck, A.S. Gatesman, A.N. Monteiro, M.J. Eck and **D.C. Flynn**. 2003. Specificity in signaling by cYes. *Frontiers in Bioscience,* 8:S185-205.
11. Clump, D.A., R. Clem, A.S. Berrebi and **D.C. Flynn**. 2003. Expression levels of the Src activating protein AFAP-110 are developmentally regulated in brain. *J. Neurobiology,* 54:473-485.
12. Qian Y., J. Luo, S.S. Leonard, G.K. Harris, **D.C. Flynn** and X. Shi. 2003. Hydrogen peroxide formation and actin filament reorganization by CDC42 is essential for ethanol-induced *in vitro* angiogenesis. *J. Biol. Chem.* 278:16189-16197.
13. Summy J.M., Y. Qian, B.-H. Jiang, A. Gatesman, A. Guappone-Koay, X. Shi and **D.C. Flynn**. 2003. The c-Yes Amino Terminal SH4 and Unique Domains Prevent Actin Filament Rearrangement and Phosphatidylinositol-3-Kinase Activation by Src^{527F}/c-Yes Chimeric Proteins. *J. Cell Science,* 116:2585-2598.
14. Qian, Y., J.M. Baisden, H. Zot, L. Cherezova, N. Mazloum, M.Y. Lee, I. Qazi, A. Guappone-Koay, and **D.C. Flynn**. 2004. Analysis of the role of the leucine zipper motif in regulating the ability of AFAP-110 to alter actin filament cross linking. *Journal of Cellular Biochemistry* 91:602-620. [Cover Photo].
15. Qian, Y., L. Corum, Q. Meng, J. Blenis, J.Z. Zheng, X. Shi, **D.C. Flynn**, and B.-H. Jiang. 2004. PI3K induced actin filament remodeling through Akt and p70S6K1: implication of essential role in cell migration. *Am. J. Pathol. Cell Physio* 286:C153-163.
16. Belcastro M, M.R. Miller, **D.C.Flynn**, A.P. Soisson. C/EBPß Activity and HPV-16 E6/E7 mRNA Expression Are Not Altered by Imiquimod (ALDARA) in Human Cervical Cancer Cells In Vitro. *Gynecologic Oncology,* 92:660-668.
17. Gao, N., **D.C. Flynn**, V. Walker, X. Shi, B.-H. Jiang. 2004. The G1 cell cycle progression and the expression of G1 cyclins are regulated by PI3K/AKT/mTOR/p70S6K1 signaling in human ovarian cancer cells. *AJP-Cell Biology* 287(2):C281-291.
18. Gatesman, A; JM Baisden, VG Walker, SA Weed and **D.C. Flynn**. 2004. Protein Kinase Cα activates cSrc and alters actin filament integrity via AFAP-110. *Mol. Cell. Biol*. 24:7578-7597.
19. Qian, Y., K.J. Liu, **D.C. Flynn**, V. Castranova and X. Shi. 2005. Cdc42-mediated actin filament reorganization regulates arsenic-induced NADPH oxidase activation and cell migration. *J. Biol. Chem*., 280: 3875-3884. [Cover Photo].
20. Qian, Y., X. Zhong, **D.C. Flynn**, J. Zheng, M. Qiao, C. Wu, S. Dehar, X. Shi and B.-H. Jiang. 2005. ILK mediates actin filament rearrangements and cell migration and invasion through PI3K/AKT/Rac1 signaling. *Oncogene* 24:3154-3165.
21. Stettner, MR, W. Wang, L.B. Nabors, S. Bharara, **D.C. Flynn**, J.R. Grammer, G.Y. Gillespie and C.L. Gladson. 2005. Lyn kinase activity is the predominant cellular Src kinase activity in glioblastoma tumor cells. *Cancer Research,* 65:5535-5543.
22. Clump, DA, I. Qazi, M. Sudol and **D.C. Flynn**. 2005. c-Yes response to growth factor activation. *Growth Factors, in press*.

Peter M. Gannett, Ph.D.
Professor of Medicinal Chemistry
Associate Chair of the Department of Basic Pharmaceutical Sciences
West Virginia University
School of Pharmacy
PO Box 9530
Morgantown, WV 26506

Phone: (304)-293-1480
FAX: (304)-293-2576
email: pgannett@hsc.wvu.edu

i) Professional Preparation

Univ of Missouri, Columbia, MO	Chemistry	B.S., 1973-1977
Univ of Wisc-Madison, WI-Chemistry	Phys. Org. Chem.	Ph.D., 1977-1982
Univ of Wisc-Madison, WI-Pharmacy	Syn Org. Chem.	Post-doctoral Fellow, 1982-1983
Eppley Cancer Inst., UNMC, Omaha, NE	Chem. Carcinogenesis	Post-doctoral Fellow, 1985-1986

ii) Appointments

7/00-Present	Professor, School of Pharmacy, West Virginia University, Morgantown, WV.
7/98-Present	Dir., Computational Chem and Molecular Modeling Lab, WV Univ, Morgantonw, WV
10/97-Present	Assoc. Chair, Dept. Basic Pharmaceut. Sci., Pharmacy, WV Univ, Morgantown, WV
12/95-8/31/97	Interim Chair, Dept. Basic Pharmaceut. Sci., Pharmacy, WV Univ, Morgantown, WV
7/94-Present	Associate Professor, School of Pharmacy, WV Univ, Morgantown, WV.
4/90-6/94	Assistant Professor, School of Pharmacy, WV Univ, Morgantown, WV.
5/88-4/90	Research Assistant Professor, Eppley Cancer Inst., UNMC, Omaha, NE
10/86-5/88	Research Instructor, Eppley Cancer Inst., UNMC, Omaha, NE
8/85-9/86	Research Associate, Eppley Cancer Inst., UNMC, Omaha, NE
8/83-7/85	Sr. Res. Chemist, Organic and Rubber Chemicals, Mobay Chemical Corp., Pgh, PA
4/82-7/83	Research Associate, Dept. of Pharmacy, Univ of Wisconsin-Madison, Madison, WI

iii) Publications

a) Related to proposed project

1) Gannett, P.M., Heavner, S., Daft, J.R., Shaughnessy, K., Epperson, J.D., Greenbaum, N.L. "Synthesis, Properties, and NMR Studies of a C8-Phenylguanine Modified Oligonucleotide that Preferentially Adopts the Z-DNA Conformation." (2003) Chem. Res. Toxicol. **16**:1385-1394.
2) Western, E.C., Daft, J.R., Johnson, II, E.M. and Gannett, P.M., and Shaughnessy, K.H." (2003) J. Org. Chem. **68**:6767-6774.
3) Gannett, P.M., Darian, E., Powell, J.H., Johnson, III, E.M., Mundoma, C., Greenbaum, N.L., Ramsey, C.M., Dalal, N.S., Budil, D.E. "Probing Triplex Formation by EPR Spectroscopy Using a Newly Synthesized Spin Label for Oligonucleotides", (2002) Nucl. Acids Res. **30**:5328-5337.
4) Tracy, T.S., Hummel, M.A., Gannett, P.M., and Aguilar, J.S. Effector-Mediated Alteration of Substrate Orientation in Cytochrome P450 Enzymes." (2004) Biochemistry, **43**:7207-7214.

b) Other significant publications

1) Gannett, P.M., Johnson, II, E.M., Grimes, M.A., Myers, A.L., Deavers, III, R.E., Tracy, T.S. (2003) "Synthesis of Deuterated 4,4'-Diaminodiphenylsulfone (Dapsone) and Related Analogs" J. Labelled Compds Radiopharmaceut, **46**:107-114.
2) Powell, J.H., and Gannett, P.M. "Mechanisms of Carcinogenicity of Aryl Hydrazines, Aryl Hydrazides, and Arenediazonium Ions." (2002) J. Environ. Pathol. Toxicol. Oncol. **21**:1-32.
3) Taylor, M.D., Antonini, J.M., Roberts, J.R., Leonard, S.S., Shi, X., Gannett, P.M., Hubbs, A.F., Reasor, M.J. "Intratracheal Amiodarone Administration to F344 Rats Directly Damages Lung Airway and Parenchymal Cells", (2003) Am. J. Resp. Cell and Mol. Biol., **188**:92-103.

4) Western, E.C., Daft, J.R., Johnson, II, E.M. and Gannett, P.M., and Shaughnessy, K.H. Efficient One-Step Suzuki Arylation of Unprotected Halonucleosides, Using Water-Soluble Palladium Catalysts. (2003) J. Org. Chem. **68**:6767-6774.
5) Darian, E. and Gannett, P.M. Application of Molecular Dynamics to Spin-labeled Oligonucleotides, (2004) J. Biomolecular Structure and Dynamics, In Press.

iv) Synergistic Activities

1) Developed and current director of the Computational Chemistry and Molecular Modeling Laboratory, WVU (Supports WVU Departments of Biochemistry, Chemistry, Microbiology, Pharmacology, Pharmacy, National Institute for Occupational Safety and Health, Mylan Pharmaceuticals)
2) Manager, WVU School of Pharmacy NMR laboratory (Supports WVU Departments of Biochemistry, Chemistry, Microbiology, Pharmacology, Pharmacy, National Institute for Occupational Safety and Health, Mylan Pharmaceuticals).
3) Mentor in the WV-BRIN and WV-INBRE program (2002-present, mentor to Dr. Jarrett Aguilar, West Liberty State College).

v) Collaborators and Other Affiliations

a) Collaborators and Co-Editors

Abate, M.A	WV University, School of Pharmacy, Clinical Pharmacy Dept, Morgantown, WV
Brunel, L.-C.	National High Field Magnet Laboratory, Tallahassee, FL
Budil, D	Northeastern University, Department of Chemistry, Boston, MA
Dalal, N.	Florida State University, Department of Chemistry, Tallahassee, FL
Greenbaum, N.L.	Florida State University, Department of Chemistry, Tallahassee, FL
Lawson, T	Eppley Cancer Research Institute, Univ of NE Med Ctr (UNMC), Omaha, NE
Shaughnessy, K.H.	The University of Alabama, Department of Chemistry, Tuscaloosa, Al
Shi, X.,	National Institutes for Occupational Safety and Health, Morgantown, WV
Strobl, J.	West Virginia University, Department of Pharmacology and Toxicology
Toth, B.	Eppley Cancer Research Institute, UNMC, Omaha, NE
Tracy, T.S.	University of Minnesota, College of Pharmacy, Minneapolis, MN

b) Graduate and Postdoctoral Advisors

Stephen F. Nelsen	University of Wisconsin-Madison, Department of Chemistry
Charles Sih	University of Wisconsin-Madison, Department of Pharmacy
Bela Toth	University of Nebraska Medical Center, Eppley Cancer Institute, Omaha, NE

c) Thesis Advisor and Postgraduate-Scholar Sponsor

Wai-Ming Yau	(National Institutes of Health)
Deepak Thakkar	(Triplex Pharmaceuticals, Houston, TX)
Claudius Mundoma	(Florida State University)
Jeannine Powell	(Beverly Healthcare)
Eva Darian	(Nat'l Institute for Occupation Safety and Health)
Sue Heavner	(Mylan Pharmaceuticals)

vii) Current Funding (PI and Co-I)

1) NIH: Mechanisms of Atypical Drug Kinetics and Interactions, $1,252,000 2005-2009
2) NSF, Synthesis of complex biologically active compounds for use as probe molecules on a biological sensor, $294,000, 2002-2005.
3) NSF: Nanofilament Directional Control within a Hybrid Microelectronic Actin-Myosin, $129,988, 2004-2005.
4) NIH: Pharmacogenetics and Drug Interactions, $1,220,000, 2004-2008.
5) NIH: WV INBRE, $770,434, 06/01/04-05/31/09
6) WV EPSCoR, Training Grant in Cancer Nanotechnology, $1,400,000, 1/1/05-12/31/08

Biographical Sketch: Philippe T. Georgel, Ph.D.

(a) Professional Preparation

University of Poitiers , France	M.S. (Cell Biology, Physiology)	1988
Oregon St. Univ., Corvallis, OR	Ph.D. (Biochemistry & Biophysics)	1993
NIH, Bethesda, MD	Visiting Associate (Molecular Biology)	1993-1997

(b) Appointments

Marshall University, Huntington, WV, Associate Professor (Tenure-track), Department of Biological Sciences, 2004 to present

Marshall University, Huntington, WV, Assistant Professor (Tenure-track), Department of Biological Sciences, 2002-2004

University of Texas, Assistant Professor (Research), Department of Biochemistry, 2000-2002

The University of Rochester, Rochester, NY, Assistant Professor (Research), Center for Oral Biology, 1998-1999

(c) Publications

Publications related to proposed project:

Georgel, P.T. Chromatin potentiation of the hsp70 promoter is linked to GAGA-factor recruitment. (in press August 2005 issue, **Biochemistry and Cell Biology**).

Johnson, C.N., Adkins, N.L. and Georgel, P.T. Chromatin remodeling complexes: ATP-dependent machines in action. (in press August 2005 issue, **Biochemistry and Cell Biology**).

Adkins, N.A, Watts, M. and Georgel, P.T. To the 30-nm Chromatin Fiber and Beyond. invited review for **Biophysica and Biochemica Acta**. FASEB meeting Chromatin and Transcription special issue, Vol. **1677**. pp 12-23 (2004)

Georgel, P.T. and Hansen, J.C. Quantitative Characterization of Specific Genomic Promoters Using Agarose Gel Electrophoresis. **Biopolymers**, Vol. 68 pp 557-562 (2003) Chromatin Special Issue. www3.interscience.wiley.com/cgi-bin/jissue/104083881

Georgel, P.T., Fletcher, T.M., Hager, G.L. and Hansen, J.C. Formation of higher-order secondary and tertiary chromatin structures by genomic mouse mammary tumor virus promoters. **Genes and Development** Vol. 17 (13) pp 1617-1629 (2003). www.genesdev.org/cgi/content/full/17/13/1617

Other significant publications:

P.T., Horowitz-Scherer, R.A., Adkins, N., Woodcock, C.L., Wade, P.A. and Hansen, J.C. Chromatin compaction by human MeCP2: Assembly of novel secondary chromatin structures in the absence of DNA methylation.Georgel, **Journal of Biological Chemistry** 2003 Vol. 278 (34). Pp 32181-32188. www.jbc.org/cgi/content/full/278/34/32181

Georgel, P.T, Debeer, M.A, Pietz, G., Fox, C.A and Hansen, J.C. Sir3p-dependent assembly of chromatin suprastructure *in vitro*. **P.N.A.S. USA** Vol.**98** (15). pp 8584-8589 (2001) www.pnas.org/cgi/content/full/98/15/8584

Georgel, P.T., Tsukiyama, T. and Wu, C. Role of Histone Tails in Nucleosome Remodeling by Drosophila NURF. **EMBO Journal** Vol.16 (15).pp 4717-4726 (1997). embojournal.npgjournals.com/cgi/content/full/16/15/4717

Adkins, N., Watts, M. and Georgel, P.T. To the 30-nm chromatin fiber and beyond. **Biochimica and Biophysica Acta** Vol. pp (2003). Publication July 12, 2003 (FASEB meeting Chromatin and Transcription special edition) www.sciencedirect.com/science

Robert, C.H. and Georgel, P.T. Differential core histone binding behavior: RNA polymerase I promoter region vs. 5S rDNA positioning DNA sequences. **Cell Biology and Biochemistry** Vol. 37 (1) pp 1-13 (2002)

(d) Synergistic Activity

Joint Appointment at the Marshall University School of Medicine, Department of Biochemistry and Molecular Biology (since 2002).

EPSCoR Thematic Leader for Marshall University (2005).

Student training: Currently training one graduate MS (**Cotteka Johnson**) and three undergraduate students (**Joshua Lewis, Jennifer Leidy** and **Thomas Hagerman**).
Ph.D. advisor for Nicholas L. Adkins and Cotteka Johnson (starting in Fall 2005).
Summer 2004: SURF/REU students (**Joshua Lewis** and **Jennifer Leidy**).
2002-2003 Biological Sciences under-graduate students (**Shawna Blaney**, **Elizabeth Hatcher** and **Meagan Watts**) working on chromatin reconstitution and nucleosome mobility at Marshall University.
Training of two Biology undergraduate students (**Eriko Greene** over a one and a half year period and **Sarah Gleason** over a three month period) at the University of Rochester, NY.
Critical ad hoc *reviewing of scientific manuscripts for the journals*: Science, Journal of Biological Sciences, Bioch. BioPhys. Res. Communications, Archives of Biochemistry and Biophysics and Journal of Biological Chemistry, European Journal of Biology.
Grant reviewer for: **NSF** and the **Alberta Cancer panel**.
Meeting Organization: Co-organizer of the Marshall University Symposium: "Frontiers in Life Science: from DNA to Phenotypes" to be held at Marshall University, Huntington, March 29, 2004; Co-organizer of the mini-symposium: "DNA and Proteins, dancing partners" at the Carnegie Institute in Washington DC. November 1996.
Jury member for the **West Virginia Science Fair** held in Huntington, WV on 3/29/03, 3/27/04 and 4/02/05.
Elected *Member of the "Sigma Xi" Research Society* in April 2005.

(e) Collaborations & Other Affiliation

Collaborators:

France Carrier. Assistant Professor, University of Maryland, Baltimore, MD
David C. Culp, Associate Professor. The University of Rochester, Rochester, NY
Terrace Fletcher. Assistant Professor, University of Miami, School of Medicine, Department of Biochemistry and Molecular Biology, Miami, FL
Albert J. Fornace Jr. Senior Investigator. Basic Research Laboratory. NIH, NCI Bethesda, MD
Catherine Fox, Assistant Professor, University of Wisconsin, Madison, WI
Gordon Hager, Chief of the Laboratory of Receptor Biology and Gene Expression in the Division of Basic Sciences. NIH, NCI Bethesda, MD
Jeffrey, C. Hansen. Professor, Department of Biochemistry, Colorado State University, Fort Collins, CO.
Michael, L. Norton. Professor, Department of Chemistry, Marshall University, Huntington, WV
M. Frances Shannon. Senior Fellow and Head of Division of Molecular Bioscience, Australian National university, Canberra, Australia
Toshio Tsukiyama. Assistant Member, Basic Sciences Division, Fred Hutchinson Cancer center, Seattle Washington
Paul, A. Wade. Investigator, Unit on Eukaryotic Transcriptional Regulation, Laboratory of Molecular Carcinogenesis NIEHS, Research Triangle Park, NC
Christopher, L. Woodcock. Chairman of the Department of Biology, University of Massachusetts, Amherst, MA

Graduate and Postdoctoral Advisors:

Graduate advisor: Professor Emeritus **Kensal, E. van Holde**, Oregon State University, Corvallis, OR
Post-graduate advisor: Associate Professor **Gary Merrill**, Oregon State University, Corvallis, OR
Post-graduate advisor: **Carl Wu**, Chief of the Laboratory of Molecular Cell Biology. NIH, NCI, Bethesda, MD

Thesis Advisor and Postgraduate-Scholar Sponsor:

1) Fellowship from the "Société de Secours des Amis des Sciences", France (February 1993 to October 1993).
2) Fellowship from the Foundation for Advances and Education in Science (FAES, July 1993 to October 1993).

Biographical Sketch: Marcia A. Harrison, Ph.D.

(a) Professional Preparation

University of Vermont	B.S. (Botany)	1977
University of Michigan	M.S. (Biology)	1978
University of Michigan	Ph.D. (Botany)	1983
Washington University	NASA Post-doctoral Fellow	1983-1985
Washington University	Postdoctoral Research Associate	1985-1986.

(b) Appointments

Marshall University, Huntington, WV, Professor, 1998 to present
Marshall University, Huntington, WV, Interim Division Head of Biological Sciences, 1998-2000
Marshall University, Huntington, WV, Associate Professor, 1992-1998
Marshall University, Huntington, WV, Botany Division Coordinator, 1990-1991
Marshall University, Huntington, WV, Assistant Professor, 1986-1992
Washington University, St. Louis, MO, Lecturer for plant physiology, 1983
University of Michigan, Ann Arbor, MI, Teaching Assistant: Plant Physiology, Cellular and Molecular Biology, Introductory Biology, Genetics, and Practical Botany, 1978-1982

(c) Publications

Publications related to proposed project:

Jenski, L.J., N.D. Lees, and M.A. Harrison. 2005. Getting Attention for New Initiatives without Making It "Just More Work"! The Department Chair 16: 15-17.

Other significant publications:

Harrison, M.A. 2005. Plant Cell Signaling in *Plant Cell Biology*, W.V. Dashek (ed), Science Publishers, Enfield, NH (in press)

Steed C.L., L.K. Taylor, and M.A. Harrison. 2004. Red-light regulation of ethylene biosynthesis and gravitropism in etiolated pea stems. *Plant Growth Regulation* 43: 117-125.

Bassett, C.L., Nickerson, M.L., Farrell, R.E. and Harrison, M. 2004. Multiple Transcripts of a Leucine-rich Repeat Receptor Kinase from Morning Glory Originate from Different TATA boxes in a Tissue-specific Manner. *Molecular & General Genetics* 271: 752 – 760.

Gonzales, D., J. Traylor, A. Hubbard, B. Lowman, and M.A. Harrison. 1999. Growth and gravitropic curvature in ethylene mutants of *Arabidopsis thaliana*. *Proc. WV Acad. Sci.* 71: 33-42

Steed, C.L. and M.A. Harrison. 1993. Effect of short-term heat-stress on the regulation of ethylene production in etiolated pea stems. *Physiol. Plant.* 87:103-107

(d) Synergistic Activity

Activities in Professional Societies:

Director, West Virginia State Science and Engineering Fair, 2000 to present. This is the state-wide competition for students in grades 9-12. The event has included invited speakers, outreach workshops, public viewing of projects, and an award of a four-year tuition waiver to Marshall University.

President, The WV Jr. Academy of Science, 1999-present. The organization oversees the Science Fair website, publishes a newsletter on science research, and oversees research grants.

Education Committee of the American Society for Gravitational and Space Biology, 1994 to present.

Women in Plant Biology, 1986-present, attendance at annual events at the American Society of Plant Biologists meetings

Collaborative Groups:

CellCentral: A collaborative group focused on research and teaching of cell biology and biotechnology. The group was established in Fall 200 to coordinate the teaching and research space into a shared area of dedicated rooms for specific research/teaching purposes in conjunction with the teaching lab. Continued the development of the http://www.marshall.edu/cellcentral web site to organize facilities and equipment in the cell biology laboratory facility

Recent Presentations of Undergraduate and Graduate Research Conducted at Marshall University:

Porter, J.E., J.D. Hogan, and MA. Harrison. 2004. The interacting roles of light regulation and ethylene biosynthesis in modulating hypocotyl gravitropism Poster presented at the 15th International Conference on Arabidopsis Research, Berlin, Germany

Harrison, M.A. and J. E. Porter. 2003. Role of the ethylene biosynthesis gene, 1-aminocyclopropane-1-carboxylic acid synthase (ACS), in regulating stem gravitropism. Poster presentation at meeting of The American Society for Gravitational and Space Biology, Huntsville, Al

Gilkerson, J. and M. A. Harrison. 2003. Regulation of a Peach Type II Chlorophyll a/b-binding Protein Gene by Exogenous Ethylene. Plant Biology 2003: 147. Poster at the American Society of Plant Biologist meeting, Honolulu, HI

Harrison M.A. 2003. Red-light regulation of ethylene biosynthesis and gravitropism in etiolated pea stems. Plant Biology 2003: 155. Poster at the American Society of Plant Biologist meeting, Honolulu, HI

Porter, J.E. and M.A. Harrison 2003. Role of ethylene biosynthesis in hypocotyl gravitropism. Poster presentation at the 14th International Conference on Arabidopsis Research, Madison, WI

Teaching Responsibilities 2001-2005:

Integrated Science and Technology: Living in Space: Fall 2002
Graduate Student Seminar I: Fall 2004
Graduate Student Seminar II: Fall 2001, Fall 2004
Plant Physiology: Spring 2001, Spring 2003; Spring 2005
Plant Growth and Development: Spring 2002, Spring 2004
Principles of Biology: Fall 2004
Principles of Cell Biology: Fall 2001 through Spring 2004; Spring 2005

Women, Minority, and First Generation College Student Researchers Mentored from 2000-2004:

Mia Brown - 2003 to present
Michaela Rivera - 2004 to present
Jonathan Gilkerson - currently in the Plant Biology Ph.D. program at University of California, Davis
Jessica Casto - SURF student 2004
John Porter- 2003-2004, SURF student 2003, graduated May 2004
Saba Keshavarzian –2003 - 2004
Jessica Casto - SURF student 2004
Kim Lee Jones - 2002-2003
Amanda Knapp - MU-SURF student 2003, Graduated Dec. 2003
Amy Shah - 2002-2003, currently attending medical school
Kristin Winland - 2001, currently in a Ph.D. program at Tufts University
Brandy VanAtter - 2000, currently in medical school
Dora Gonzales - minority student 1999-2000, currently teaches at Marshall Community College

(e) Collaborations & Other Affiliation

Collaborators & Co-Editors:

Dr. Jaroslava Miksovska, Department of Chemistry, Marshall University
Dr. Carole Bassett, USDA Appalachian Fruit Research Station
Dr. William Dashek (retired), 8808-209 Three Chopt Rd., Richmond, VA
Dr. Elizabeth E. Murray, Department of Integrated Science and Technology, Marshall University
Dr. Laura Jenski, Department of Biological Sciences, Marshall University
Dr. Susan Jackman, Department of Microbiology, Immunology and Molecular Biology
Dr. Nicola LoCascio, Department of Biological Sciences, Marshall University

Graduate and Postdoctoral Advisors:

Dr. Peter Kaufman, University of Michigan, Ann Arbor, MI
Dr. Barbara Pickard, Washington University, St. Louis, MO

Master Thesis Advisor:

Candice Steed – Novartis (WV)
Lewis K. Taylor Jr. - WV
Lilian Rena Jones – ATCC, Manassas, VA

Dimitris Korakakis
Lane Department of Computer
Science and Electrical Engineering
West Virginia University
PO Box 6109
Morgantown, WV 26506-6109

Tel: (304) 293-0405 x2512
Fax: (304) 293-8602
e-mail: dimitris.korakakis@mail.wvu.edu

1. Education

Ph.D., Electrical Engineering	Boston University	1998
M.S., Manufacturing Engineering	Boston University	1994
B.S., Theoretical Physics	London University	1986

2. Appointments

Assistant Professor	Lane Department of Computer Science and Electrical Engineering	2002-present
Research Assistant Professor	Department of Physics West Virginia University	2000-2002
Research Associate	School of Physics and Astronomy and School of Electrical and Electronic Engineering University of Nottingham	1997-2000

D. Korakakis was trained during his Ph.D. studies on the growth by Molecular Beam Epitaxy and characterization of III-nitrides thin films and heterostructures. During that period he interacted strongly with members of the Physics department on the structural characterization, by x-ray diffraction techniques. At the University of Nottingham he acted as the link between the School of Physics and the School of Electrical and Electronic Engineering to which he was jointly appointed. He was actively involved on the development of homo- and hetero-epitaxial growth of III-nitride films and heterostructures as well as the development of etching and processing of these layers for device fabrication. He has 37 refereed publications in this area and 10 invited and contributed presentations in international conferences.

3. Publications

Five Most Pertinent Publications (37 total refereed publications)

1. "Growth and device applications of III-nitrides by MBE", T.D. Moustakas, E. Iliopoulos, A.V. Sampath, H.M. Ng, D. Doppalapudi, M. Misra, D. Korakakis, R. Singh, **J. of Crys. Growth, 227 (2001)**.
2. "Ga-Metal Inclusions in GaN Films Grown on Sapphire", A.Blant, S.V. Novikov, T.S. Cheng, L B Flannery, I Harrison, R.P. Campion, D. Korakakis, E.C. Larkins, Y. Kribes, C.T. Foxon, **J. of Crys. Growth, 203, 349 (1999)**.
3. "The Initiation of GaN Growth by Molecular Beam Epitaxy on GaN Composite Substrates", T.S. Cheng, S.V. Novikov, V.B. Lebedev, R.P. Campion, N.J. Jeffs, Y.V. Melnik, D.V. Tsvetkov, S.I. Stepanov, A.E. Cherenkov, V.A. Dmitriev, D. Korakakis, O.H. Hughes, C.T. Foxon, **J. of Crys. Growth, 197, 12 (1999)**.

4. "Homo- and Hetero-epitaxial GaN Grown by Molecular Beam Epitaxy", C.T. Foxon, T.S. Cheng, D. Korakakis, S.V. Novikov, R.P. Campion, I. Grzegory, S. Porowski, M. Albrecht, H.P. Strunk **MRS Internet J. Nitride Semicon. Res, 4 S1, U492 (1999).**
5. "MBE Growth and Doping of III-V Nitrides", H.M. Ng, D. Doppalapudi, D. Korakakis, R. Singh, T.D. Moustakas, **J. of Crys. Growth, 190, 349 (1998)**.

Five Additional Publications

1. "Photoconductive Detectors Based on Partially Ordered $Al_xGa_{1-x}N$ Alloys Grown by Molecular Beam Epitaxy", M. Misra, D. Korakakis, H.M. Ng, T.D. Moustakas, **Appl. Phys. Lett. 74, 2203 (1999)**.
2. "Growth and Relaxation of GaN/AlGaN Heterostructures grown by MBE on pressure grown GaN (0001) Substrates", S.H. Christiansen, M. Albrecht, H.P. Strunk, C.T. Foxon, D.Korakakis, I. Grzegory, S. Porowski, **Phys. Stat. Sol. (a), 176, No. 1, 285 (1999)**.
3. "High-temperature processing of GaN: The influence of the annealing ambient on strain in GaN", J.M. Hayes, M. Kuball, A. Bell, I. Harrison, D. Korakakis, C.T. Foxon, **Appl. Phys. Lett. 75, 2097 (1998)**.
4. "X-ray Characterization of GaN/AlGaN Multiple Quantum Wells for Laser Diodes", D. Korakakis, K.F. Ludwig, Jr. and T.D. Moustakas, **Appl. Phys. Lett. 72, 1004 (1998)**.
5. "Long Range Ordering in $Al_xGa_{1-x}N$ Films Grown by ECR Assisted MBE", D. Korakakis, K. F. Ludwig, Jr., T.D. Moustakas, **Appl. Phys. Lett. 71, 72 (1997)**.

4. Research Funding

1. T.H. Myers (PI), D. Korakakis, C. Stinespring, "Alternative Approaches To P-Type Doping In GaN And Related Alloys", US Army Research Office, $560,000 (2001-2005)
2. D Korakakis (PI), T.H. Myers, K. Meehan, "Investigation of Bandgap Engineering Techniques to Obtain Long Wavelength Emission from InGaNAs Fabry-Perot Heterojunctions", National Science Foundation, $307,532 (2001-2005)
3. T.H. Myers (PI), D. Korakakis, "Acquisition of a Molecular Beam Epitaxy System for growth and p-type doping of GaN, InN, AlN and related alloys", Office of Naval Research, $400,000 (2002-2005)
4. L. Hornak (PI), A. Timperman, D. Korakakis, "Towards Fieldable Rapid Bioagent Detection: Advanced Resonant Optical Waveguide and Biolayer Structures for Integrated Biosensing", Office of Naval Research, $500,000 (2003-2006)

5. Collaborators and Other Affiliations

Collaborators C.T. Foxon, E.C. Larkins (University of Nottingham, UK)
S. Porowski, I. Grzegory (Polish Academy of Sciences)
M. Albrecht (University of Erlangen, Germany)
T.D. Moustakas (Boston University)
E. Palloura (Aristotle University, Greece)

Graduate Advisor T.D. Moustakas, Boston University, Boston MA

Biographical Sketch: A. Joseph Kusimo,

a. Professional Preparation

University of Wisconsin	Industrial Engineering	B.S. 1978
Texas A&M University	Industrial Engr. / Operations Research	M.S 1980

Registered Professional Engineer – 1983
Certified Six Sigma Black Belt - 2004

b. Appointments

2005 – Present NASA Program Coordinator, West Virginia State University
2002 – 2004 Six Sigma Technology – Black Belt/Green Belt, Dow Chemical Company
2001 – 2004 Sr. Engineering Manager, Dow Chemical Company
2001 – 2004 Change Leader/Manager, Dow Chemical Company
1995 – 2004 Sr. Corporate Recruiter (BS, MS, Ph.D. - STEM disciplines) and University Liaison
1995 – 2001 Manager, Process Automation/Control, Joint Ventures & Licensing, Union Carbide Corp.
1994 – 2001 Program Manager and Sr. Project Manager, Union Carbide Corp.
1992 – 1994 Manager, Process Control System, Union Carbide Corp.
1989 – 1992 Manager, Shared Service Business, Union Carbide Corp.
1988 - 1995 Corporate Recruiter (BS)
1988 – 1989 IT Project Manager, Union Carbide Corp.
1986 – 1987 Supply Chain Planning Manager, Union Carbide Corp.
1982 – 1986 Adjunct Professor of Computer Science, West Virginia State University
1980 – 1985 Operations Research Engineer, Union Carbide Corp.

c. Experiences

25 years of Professional Engineering experience
22 years of STEM Outreach experience
17 years of Project Management experience
16 years of Organizational Leadership experience

d. Accomplishments (Partial List)

Organizational Leadership (16 years)

Union Carbide Management Team - 13 years
Dow Chemical Leadership team – 3 years

Project Management (17 years)

1988 - Dubai, *United Arab Emirates,* Managed and Completed $36.00MM Capital Infrastructure projects.
1989 – 2001 Completed 24 projects in the United States, 6 projects in China, 4 in Canada, 3 projects each in South Korea, Germany, Japan, Italy, 2 projects each in Britain, Saudi Arabia, and one project each in Belgium, Netherlands, Spain, France, Egypt, South Africa, India, Qatar and Kuwait. The average capital project cost was $26.785MM.

STEM Outreach (22 years)

Union Carbide Corporation University Liaison to Texas A&M University, Louisiana Tech University, North Carolina A&T University, Howard University,
Dow Chemical Corporation University Liaison to Florida A&M University
Dow Promise WV Leader – Dow Chemical Corp. Community Outreach program for STEM
Math & Science Community Tutor – Inner City outreach program – 22 years

Biographical Sketch - David Lederman

I. Professional Preparation

B. S. with Honors, Physics	*Stanford University*	1988
Ph.D., Physics	*University of California – Santa Barbara*	1992
Postdoctoral Researcher	*University of California – San Diego*	1992-1993

II. Appointments

Woodburn Professor	*Eberly College of Arts and Sciences, West Virginia University*	2004-2006
Professor	*Physics Dept., West Virginia University*	2005 - Present
Associate Professor	*Physics Dept., West Virginia University*	2001 - 2005
Assistant Professor	*Physics Dept., West Virginia University*	1995 - 2001
Project Scientist	*University of California - San Diego*	1993 - 1995
Lecturer	*Physics Dept., University of California - San Diego*	1994

III. Publications

A. RELATED PUBLICATIONS

1. **Monte Carlo Simulations of Exchange Bias of Ferromagnetic Thin Films on FeF_2 (110),** D. Lederman, R. Ramírez, and M. Kiwi, *Phys. Rev B* **70**, 184422 (2004).
2. **Magnetooptic properties of Fe/Pd and Co/Pd bilayers under hydrogen absorption**, D. Lederman, R. J. Matelon, G. B. Cabrera, E. H. Morales, Y. Wang, U. G. Volkmann, and A. L. Cabrera, *Appl. Phys. Lett.* **85**, 615 (2004).
3. **Electrical and Magnetic Properties of $La_{2/3}Ca_{1/3}MnO_3/YBa_2Cu_3O_{7-\delta}/ La_{2/3}Ca_{1/3}MnO_3$ Trilayers**, F. Perez, E. Baca, W. Saldarriaga, L. F. Castro, M. E. Gomez, P. Prieto, H. Shi, and D. Lederman, *J. Appl. Phys.* **97**, 10B116 (2005)
4. **Exchange Bias and Enhancement of Néel Temperature in Thin NiF_2 Films,** H. Shi, D. Lederman, K. V. O'Donovan, and J. A. Borchers, *Phys. Rev. B* **69**, 214416 (2004).
5. **Exchange-Induced Anisotropies at Ferromagnetic/Antiferromagnetic Interfaces Above and Below the Néel Temperature**, M. Grimsditch, A. Hoffmann, P. Vavassori, H. Shi, and D. Lederman, *Phys. Rev. Lett.* **90**, 257201 (2003).

B. OTHER SIGNIFICANT PUBLICATIONS

1. **The Surface Spin-Flop Transition in Epitaxial Co/Re Superlattices**, T. Charlton and D. Lederman, *J. Appl. Phys.* **93**, 7705 (2003).
2. **Order Parameter Criticality of the d=3 Random-Field Ising Antiferromagnet $Fe_{0.84}Zn_{0.16}F_2$**, F. Ye, L. Zhou, S. Larochelle, L.Lu, D. P. Belanger, M. Greven, and D. Lederman, *Phys. Rev. Lett.* **89**, 157202 (2002).
3. **Hysteretic Ferromagnetic Resonance as a Probe for Coercivity, Exchange Bias, and Loop Asymmetry**, A. Punnoose, E. H. Morales, Y. Wang, D. Lederman, and M. S. Seehra, *J. Appl. Phys.* **93**, 771 (2003).

4. **Evolution of Strain-Dependent Transport Properties in Ultra Thin $La_{0.67}Sr_{0.33}MnO_3$ Films**, H. L. Ju, K. M. Krishnan, and D. Lederman, *J. Appl. Phys.* **83**, 7073 (1998).
5. **Surface Smoothing and Crystalline Reorientation in Thin Cobalt Films**, H. T. Shi and D. Lederman, *Phys. Rev. B* **58**, R1778 (1998).

IV. Synergistic Activities

- Awarded Outstanding Researcher Award, Eberly College of Arts and Sciences, West Virginia University, 2004.
- Advisor, West Virginia University Chapter Society of Physics Students, 1999 – present.
- Developed novel, interactive, peer-instruction based lectures for health science physics courses. Included preparation of two entire semesters using PowerPoint and purchasing IR feedback system, now used by approximately 8 faculty members (2002-2003).
- Developed hands-on physics course for middle school students in rural West Virginia, with aim of fostering interest in science among underprivileged students (2000-2001, 2003).
- Developed ties with local company (FMW Composites) for SEM characterization of SiC fibers, thus fostering high-tech industry in West Virginia (2003-Present).
- Journal referee for *J. Appl. Phys.*, *Appl. Phys. Lett.*, *Phys. Rev. B*, *Phys. Rev. Lett*.
- MRS Symposium Organizer, Fall 2003
- Member Los Alamos Neutron Scattering Center (LANSCE) Program Advisory Committee
- Member at Large, Forum of International Physics, American Physical Society
- Member American Physical Society, Materials Research Society, National Society of Hispanic Physicists
- Faculty WVNano Committee member, helped draft nanoscience strategy at WVU

V. Collaborators and Other Affiliations

A. Collaborators and Co-Editors

D. Belanger, UC-Santa Cruz; J. Borchers, NIST; R. Erwin; NIST; E. E. Fullerton, HGST; M. Grimsditch, Argonne Natl. Lab.; G. P. Felcher, Argonne Natl. Lab.; A. Hoffmann, Argonne Natl. Lab.; K. V. O'Donovan, NIST; M. J. Pechan, Miami U.; J. Stohr, SSRL; S. Te-Velthuis, Argonne Natl. Lab.

B. Graduate and Postdoctoral Advisors

Graduate Advisor: Prof. V. Jaccarino, Dept. of Physics, University of California - Santa Barbara
Postdoctoral Advisor: Prof. I. K. Schuller, Dept. of Physics, University of California - San Diego

B. Thesis Advisor and Postgraduate-Scholar Sponsor

Former Postdoctoral Advisees: Hongtao Shi, now Professor at Sonoma State U. in CA.
Current Postdoctoral Advisees: Zhonghyan Liu, Yewhee Chye, Jianhua Gu
Former Ph.D. Students: Timothy Charlton (2001), Hongtao Shi (2002).
Former M. S. Student: Erie Morales (Dec. 2003).
Current Graduate Ph.D. Students: Debin Li, Yikwan Wang, Jorge Espinosa, Tao Liu, Felio Perez (Universidad de Cali, Colombia)

Biographical Sketch: Jaroslava Miksovska

a. Professional Preparation

Charles University at Prague	B.S. (Biochemistry)	1992
Charles University at Prague	M.S. (Biochemistry)	1994
University of Paris	Ph.D. (Biochemistry)	1998
University of Hawaii	Post-doctoral Fellow	2000-2001
University of South Florida	Post-doctoral Fellow	2002-2004

b. Appointments

Marshall University, Huntington, WV, Assistant Professor, 2004 to present

c. Publications

Publications Relevant to the Proposed Project:

Miksovska, J., Suquet, C., Satterlee, J.D., Larsen, R.W. Characterization of Conformational Changes Coupled to Ligand Photodissociation from the Heme Binding Domain of FixL. (2005) *Biochemistry*, accepted.

Miksovska, J., Gennis, R.B., and Larsen, R.W. Photothermal studies of CO photodissociation from mixed valence Escherichia coli cytochrome bo_3. *FEBS Lett*, (2005) in print.

Miksovska, J., Norstrom, J., and Larsen, R.W. Thermodynamic Profiles for CO Photodissociation from Heme Model Compounds: Effect of Proximal Ligands. *Inorganic Chemistry*, (2005) 44 (4), 1006-1014.

Miksovska, J., and Larsen, R.W. Structure-Function Relationships in Metalloproteins. *Methods in Enzymology*: Biophotonics, Marriott, G. and Parker, I., Ed. 2003, 360, part A, 302-329.

Miksovska, J., Day, J.H., Larsen, R.W. Volume and Enthalpy Changes Coupled to CO Rebinding to Horse Heart Myoglobin. *Journal of Biological Inorganic Chemistry,* 2003, 8 (6): 621-625.

Other Significant Publications-Co-Authored by Undergraduate Students:

Miksovska, J., and Larsen, R.W. Time resolved photoacoustic study of Ruthenium(II) bis (2,2'-bipyridine)(4,4'-dicarboxy-2,2'bipyridine) complex. *Inorganic Chemistry*, (2004) 43 (14), 4051-4055.

Miksovska J, and Larsen RW. Photothermal Studies of pH Induced Unfolding of Apomyoglobin. *Journal of Protein Science*, 2003, 22 (4): 387-394.

Tandori J, Miksovska J, Valerio-Lepiniec M, Schiffer M, Maroti P, Hanson DK, Sebban P. Proton uptake of Rhodobacter capsulatus reaction center mutants modified in the primary quinone environment. *Photochem Photobiol.* 2002, 75(2): 126-33.

Miksovska J, Schiffer M, Hanson DK, Sebban P. Proton uptake by bacterial reaction centers: the protein complex responds in a similar manner to the reduction of either quinone acceptor. *Proc Natl Acad Sci U S A.* 1999, 96(25):14348-53.

Miksovska J, Valerio-Lepiniec M, Schiffer M, Hanson DK, Sebban P. Mutations in the environment of the primary quinone facilitate proton delivery to the secondary quinone in bacterial photosynthetic reaction centers. *Biochemistry,* 1999, 38(1):390-8.

d. Synergistic Activity

* Development of teaching material for intermediate biochemistry course with focus on information and signal transfer.

* the interdisciplinary nature of the research in the lab involves wide range of concepts and techniques providing an opportunity for students to learn biochemistry techniques (protein purification and isolation techniques), master biophysical techniques such as time resolved spectroscopy and photothermal techniques and become familiar with data analyses software. This broad and purely interdisciplinary experience provides important contribution to students professional development.

* supervising summer research project of 4 undergraduate students, among them 2 women (one of them Hispanic).

e. Collaborations & Other Affiliation

Collaborators:

Dr. James D. Satterlee, Washington State University, Pullman, WA,

Dr. Wenji Dong, University of Alabama, Birmingham
Dr. Robert B. Gennis, University of Illinois at Urbana-Champaign, Illinois

Graduate and Postdoctoral Advisors:

Pierre Sebban, University of Paris XI, Orsay, France, Ph.D., Graduate Advisor
Randy W. Larsen, University of South Florida, Tampa, FL, Postdoctoral Advisor

Thesis Advisor and Postgraduate-Scholar Sponsor: none

Thomas H. Myers, Interim WVNano Director

I. Professional Preparation

B. S. Magna Cum Laude, Physics	North Carolina State University	1979
Ph.D., Physics	North Carolina State University	January, 1983
Postdoctoral Researcher	North Carolina State University	1983

II. Appointments

Full Professor	*Physics Dept., West Virginia University*	2002 - Present
Associate Professor	*Physics Dept., West Virginia University*	1997 - 2002
Assistant Professor	*Physics Dept., West Virginia University*	1992 - 1997
Manager, IR Materials and Devices	General Electric Electronics Laboratory Syracuse, NY	1985 - 1992
Assistant Professor	University of North Carolina at Asheville	1983 - 1985

III. Publications

A. RELATED PUBLICATIONS

1. *Xray photoelectron spectroscopy study of oxide and Te overlayers on as-grown and etched HgCdTe*, L.S. Hirsch, R. Haakenaasen, T. Colin, K.S. Ziemer, C.D. Stinespring, S. Lovold and T.H. Myers, **J. Electron. Mat. 28**,810 (1999).
2. *Characterization of Atomic Hydrogen-Etched HgCdTe Surfaces,* K. S. Ziemer and C. D. Stinespring, L. S. Hirsch and T. H. Myers, **Journal of Crystal Growth 191,** 594 (1998)
3. *Magnesium Incorporation in GaN Grown by rf-Plasma Assisted Molecular Beam Epitaxy*, A.J. Ptak, T.H. Myers, L.T. Romano, C.G. Van de Walle and J.E. Northrup, **Appl. Phys. Lett. 78**, 285 (2001).
4. *Effects of High-Energy Electrons during Growth of Wide Band Gap Semiconductors*, B.L. VanMil, A.J. Ptak, N.C. Giles, T.H. Myers, P.J. Treado, M.P. Nelson, R. Smith, and J.M. Ribar, **J. Electron. Mater. 30,** 785 (2000).
5. *Formation of BN and AlBN During Nitridation of Sapphire Using rf-Plasma Sources*, A.J. Ptak, K.S. Ziemer, L.J. Holbert, C.D. Stinespring, and T.H. Myers, **MRS Internet J. Nitride Semicond. Res. 5S1**, W3.33 (2000). Also appears in **Mat. Res. Symp. Proc. 595**. W3.33.1, (1999)

B. OTHER SIGNIFICANT PUBLICATIONS

1. "*Vacancy defects in O-doped GaN grown by molecular beam epitaxy: The role of growth polarity and stoichiometry*", M. Rummukainen, J. Oila, A. Laakso, and K. Saarinen, A. J. Ptak and T. H. Myers, **Appl. Phys. Lett. 84**, 4887 (2004).
2. *The effect on chlorine incorporation as Mg is alloyed into ZnSe,* Y. Yang, B. VanMil, L. Muratov, B.R. Cooper and T.H. Myers, **Phys. Rev. B.66, 1652XX (2002).**
3. *Faceted inversion domain boundary in GaN films doped with Mg*, L.T. Romano, J.E. Northrup, A.J. Ptak and T.H. Myers, **Appl. Phys. Lett. 77**, 2479 (2000).
4. *Point Defect Modification in Wide Band Gap Semiconductors Through Interaction with High Energy Electrons - Is RHEED Truly Benign?*, T.H. Myers, A.J. Ptak, B.L. VanMil, M.

Moldovan, P.J. Treado, M.P. Nelson, J.M. Ribar and C.T. Zugates, **J. Vac. Sci. Technol. B18(4)**, 2295 (2000).

5. *Incorporation-related structural issues for beryllium doping during growth of GaN by rf-plasma molecular beam epitaxy*, A. J. Ptak, Lijun Wang, N. C. Giles and T. H. Myers, L. T. Romano, C. Tian, R. A. Hockett, S. Mitha and P. Van Lierde, **Appl. Phys. Lett. 79,** 4524 (Dec. 2001).

IV. Synergistic Activities

- Interim Director, WVNano initiative
- Member of the Electronic Materials Committee, the organizing committee for the Electronic Materials Conference, and the organizing committee for the US Workshop on II-VI Materials.
- Governing Board Member for the Electro-Optic Alliance (2001-2003)
- Science Advisory Board Member – ChemImage, Inc..
- Program Chair for the 2004 International Workshop on Nitrides.
- Extensive course development at all levels of teaching for which received the following awards: West Virginia University Foundation Outstanding Teacher Award, Spring 2000; Outstanding Teacher Award, Eberly College of Arts and Sciences, WVU, 1999-1998

V. Collaborators and Other Affiliations

A. Collaborators and Co-Editors

Jose Arias (Rockwell Science Center), Chris Van de Walle (Xerox PARC), Jaime Freitas, Evan Glaser, Jerry Meyer, (Naval Research Laboratory), Pat Treado, (ChemImage, Inc), D. Look (Wright State), M. Berding (SRI International) A. Doolittle and B. Frazier (Georgia Institute of Technology), W. Schaff (Cornell), T. Moustakas (Boston University), R. Feenstra (Carnegie Mellone), Joan Redwing, Darrell Schlom (Penn State), J. Levy (U. of Pitt) and A. Selloni (Princeton University)

B. Graduate and Postdoctoral Advisors

Graduate Advisor: Jan F. Schetzina, North Carolina State University, Raleigh, NC

C. Thesis Advisor and Postgraduate-Scholar Sponsor

Students (in last five years, Ph. D unless otherwise noted): Randy Tompkins, Craig Swartz, Ting Liu, Kyoungae Lee, Huicheng Guo, Vladimir Stoica (M. Sc), Matthew Millecchia (M. Sc), Lauren Hirsch (M. Sc), Aaron Ptak, Brenda Van Mil.

Postgraduate Dimitris Korakakis –Research Assistant Professor 2001-2002; Postdoctoral research assistants: Krishnan Balakrishnan 2002 – 2003; Hongtao Shi 2003-2004; Yewhee Chye 2004 – present

Biographical Sketch: Michael Louis Norton, Ph.D.

(a) Professional Preparation

Louisiana State University of Shreveport	B.S. (Chemistry)	1977
Arizona State University	Ph.D. (Solid State Chemistry)	1982
Naval Weapons Center, China Lake, CA	Post-doctoral Fellow	1982-1984

(b) Appointments

Marshall University, Huntington, WV, Professor, Chemistry, 1995 to present
Marshall University, Huntington, WV, Associate Professor, Chemistry, 1991-1995
University of Georgia, Assistant Professor, Chemistry, 1984-1991

(c) Publications

Publications related to proposed project:

Dykes, A.C., Fultz, M.E., Norton, M.L. and Wright, G.L., Mirotubule-dependent PKC Localization in A7r5 Smooth Muscle Cells, American Journal Physiol. Cell Physiol., 285, C76-C87, 2003.

Gannett; P., Powell, J., Johnson, E., Darian, E., Dalal, N., Norton, M., and Budil, D. Solid Phase DNA Binding Detection by EPR Spectroscopy, Tetrahedron Letters, 43, 1931-1933, 2002

Li, C., Fultz, M.E., Geng, W., Norton, M. and Wright, G.L., Concentration-dependent phorbol stimulation of PKCa localization at the nucleus or subplasmalemma in A7r5 cells, Pflugers Arch – Eur J Physiol, 443, 38-47, 2001.

Battistella-Patterson, A., Fultz, M., Li, C., Geng, W., Norton,M., and Wright, G.; PKCa Translocation is Microtubule-Dependent in Passaged Smooth Muscle Cells. Acta Physiol. Scand., 170, 87-97, 2000.

Zill, SN, Frazier, SF, Neff, D, Quimby, L, Carney, M, DiCaprio, R, Thuma, J and Norton, M. Three Dimensional Graphic Reconstruction of the Insect Exoskeleton Through Confocal Imaging of Endogenous Fluorescence, Microscopy Res Tech; 48(6), 367-84, 2000.

.

Other significant publications:

Norton, M.L., Inventor: Methods, Probes, and Accessory Molecules for Detecting Single Nucleotide Polymorphisms, patent application number PCT/US03/15761, filed May 20, 2003.

Norton, M.L., Barhoumi, A., Neff, Toward Large Nanostructures, Proceedings 2003 3rd IEEE Conference on Nanotechnology, 432-436, 2003.

Walker, E.M., Wolfe, M.D., Norton, M.L., Walker, S.M., Jones, M.M.,Hereditary Hemochromatosis, Annals of Clinical and Laboratory Science, 28, 300-312, 1998.

Liang, M., Lackey, N., Carter, S., and Norton, M.L.; Electrodeposited Silver Arrays Fabricated Utilizing Self-Assembled Alkanethiolate Monolayer Photoresist , J. Electrochem. Soc., 143, 3117 – 3121, 1996.

Chong, Ngee-Sing, Norton, M.L., and Anderson, James L., Application of Polypyrrole Film substrates for Characterization of Metallic Electrodeposits by Transmission Electron Microscopy and Electron Diffraction , Journal of the Electrochemical Society, 138, 1263-1268, 1991.

(d) Synergistic Activity

1.) Teaching Innovations:
Developing low cost stereo projection system for classroom use
Maintain SEM and Confocal Facilities for High School, Undergraduate as well as Graduate student use
2.) Refine research tools: Applying stereoscopy to SEM cathodoluminescence
3.) Materials Research Support: Supply samples of electrocrystallized bismuth based oxide superconductors to researchers worldwide.
4.) National Service: Regularly participate in SBIR panels (sensors).
5.) Broadening Science participation: Mentor an average of 4 high school and

5 undergraduate researchers per year

(e) Collaborations & Other Affiliation

Collaborators:

Ngee-Sing Chong (Middle Tenn State U), Michael Fultz (MU), Roy Goodrich (LSU), Mark Jones (Vanderbilt), William Manner (U Carbide Technical Center), David Neff (MU), Neysa Nevins (Elizabethtown College), Richard Niles (MU), Allison Patterson (MU), William Price (MU), Nadrian Seeman (New York University), Charles Sommerville (MU), John Stickney (U of Georgia), Jay Switzer (U of Missouri, Rolla), Ernest Walker (MU), Sandra Walker (MU), Melanie Wofe (Pfizer), Gary Wright, Sr (MU), Gary Wright, Jr (MU), Sasha Zill (MU), Carolyn Matzke (CINT)

Graduate and Postdoctoral Advisors: William VonDreele (Los Alamos NL), William Glaunsinger (ASU) Robert Schwartz (Naval Weapons Center)

Thesis Advisor and Postgraduate-Scholar Sponsor:

Chad Huffman(Rice), Sirin Klinsukont, Ming Liang (NIH), Melanie Wolfe (Pfizer), Duy Bao Dinh (Med School), Brian Baker (Special Metals), Farrah Boggess, (WVSP), Ava Dykes (MUSOM), Fan Zhang (MU), Aoune Barhoumi(MU).

Aaron Timperman

(a) Professional Preparation

St. Louis University	Chemistry	B.S.	1986-1990
University of Illinois	Chemistry (Analytical)	Ph.D.	1990-1995
University of South Florida	Marine Science		1995-1997
University of Washington	Molecular Biotechnology		1997-1999

(b) Appointments

Assistant Professor, West Virginia University Department of Chemistry, 1999-current

(c) Publications

Razunguzwa, T.; **Timperman, A. T.** "Fabrication and Characterization of a Fritless Microfabricated Electroosmotic Pump with Reduced pH Dependence" *Analytical Chemistry 2004, 76,* 1336-1341

Zhang, Y and **Timperman, A. T.** "Integration of Nanocapillary Arrays into Microfluidic Devices for Use as Analyte Concentrators" *Analyst 2003, 128*, 537-542.

Razunguzwa, T; **Timperman, A. T.*** "Interfacing Microchip Capillary Electrophoresis with Electrospray Ionization Mass Spectrometry" In *Methods in Molecular Biology,* Humana Press*, accepted* May 2004.

Timperman, A. T.; Aebersold, R. "Peptide Electroextraction for Direct Coupling of in-Gel Digests with Capillary LC-MS/MS for Protein Identification and Sequencing" *Analytical Chemistry* 2000, *72*, 4115-4121.

Coble, P. G.; **Timperman, A. T.** "Fluorescence Detection of Proteins and Amino Acids in Capillary Electrophoresis Using a Post-Column Sheath Flow Reactor" *Journal of Chromatography A* 1998*, 829*, 309-315*.*

Baldwin, C.; Cumming, J.; **Timperman, A. T.** "Isolation of Naturally Occurring Aluminum Ligands Using Immobilized Metal Affinity Chromatography for Analysis by ESI-MS" *The Analyst, accepted* December 2004, anticipated publication February 2005.

Powell, M. U.; Sutton, J. N.; Del Castillo, C. E.; **Timperman, A. T.** "Marine proteomics: generation of sequence tags for dissolved proteins in seawater using tandem mass spectrometry" *Marine Chemistry,* accepted July 2004, anticipated publication February 2005.

Powell, M. J; **Timperman, A. T.** "Quantitative analysis of protein recovery from dilute, large volume samples by tangential flow ultrafiltration." *Journal of Membrane Science,* accepted December 2004, anticipated publication February 2005.

Morris, D. L.; Sutton J. N.; Harper, R. G.; **Timperman, A. T.** "Reversed Phase HPLC Separation of Human Serum Employing a Novel Saw Tooth Gradient: Toward Multidimensional Proteome Analysis" Journal of Proteome Research, *submitted* June 2004

Harper, R. G., Workman, S. R., Schuetzner, S., **Timperman, A. T.**, Sutton, J. N. "Low Molecular Weight Human Serum Proteome Using Ultrafiltration, Isoelectric Focusing and Mass Spectrometry" *Electrophoresis 2004*, vol. 25, 1299-1306.

(d) Synergistic Activities

I have developed an interdisciplinary graduate course in Proteomics. Students, from Chemistry, Biology, Microbiology, Basic Pharmaceutical Sciences, and Plant and Soil Sciences have enrolled in this course taught at WVU.

I have actively recruited minorities and women to work in my group. Currently, I have six graduate students, including an African American male, two Asian females, a white female, and two white males.

For service outside of my home institution, I organized eight invited mass spectrometry sessions for the FACSS (Federation of Analytical Chemistry & Spectroscopy Societies) 29th Annual meeting in Providence Rhode Island, October 13-17, 2002. For the first time a session on MS in marine systems was included: "Environmental Mass Spectrometry Studies in Marine Systems".

(e) Collaborators and Other Affiliations

(a) Collaborators and Co-Editors
Jonathan Cumming, WVU Department of Biology
Dan Flynn, WVU Department of Microbiology
Larry Hornak, WVU Depart of Electrical Engineering
David Lederman, WVU Department of Physics
Daniel Morris, Rose Hulman Institute of Technology, Department of Chemistry
Carlos Del Castillo, NASA Stennis Space Center

(b) Graduate and Postdoctoral Advisors
Graduate Advisor UIUC, Jonathan Sweedler
Postdoctoral advisor USF, Paula Coble
Postdoctoral advisor Institute for Systems Biology, Ruedi Aebersold

(c) Thesis Advisor and Postgraduate-Scholar Sponsor
Erica Jackson, M.S. Chemistry 2004
Matthew Powell, PhD candidate
Trust Razunguzwa, Ph.D. candidate
Carson Baldwin, M.S. student
Guimei Cai, Ph.D. student
Kathleen Kelly, Ph.D. student
Ting Zhao, Ph.D. student
Brent Reshke, Ph.D. student
Ying Zhang, postdoctoral fellow
Scott Miller, postdoctoral fellow, (WVU)
Manoj V. Warrier, postdoctoral fellow, (WVU)
Min Soo Lim, postdoctoral fellow, (WVU)

Biographical Sketch – Nianqiang Wu

I. Professional Preparation

B. S., Materials Science	*Zhejiang University, China*	1990
Ph.D., Materials Science	*Zhejiang University, China*	1997
Postdoctoral Researcher	*University of Pittsburgh, USA*	1999-2001

II. Appointments

Assistant Professor	*Department of Mechanical and Aerospace Engineering, West Virginia University*	2005-present
Research Scientist, Manager	*Keck Interdisciplinary Surface Science Center, Northwestern University*	2001 - 2005
Research Associate	*University of Pittsburgh, USA*	1999 - 2001
Research Associate	*University of Calgary, Canada*	1998-1999
Associate Professor	*Materials Science Dept., Zhejiang University, China*	1997 - 1998
Lecturer	*Materials Science Dept., Zhejiang University, China*	1995-1997

III. Publications

A. RELATED PUBLICATIONS

1. **Interaction of fatty acid monolayers with cobalt nanoparticles,** N. Q. Wu, L. Fu, M. Su, M. Aslam, K. C. Wong and V. P. Dravid, *Nano Letters*, **4** (2004), 383-386.
2. **Direct evidence of oxidized gold on supported gold catalysts,** L. Fu, N. Q. Wu, J. H. Yang, F. Qu, D. L. Johnson, M.C. Kung, H.H. Kung, V. P. Dravid, *J. Phys. Chem. B*, **109** (2005), 3704-3709.
3. **Individually-addressed large-scale patterning of conducting polymers by localized electric field,** M. Su, L. Fu, N. Q. Wu, M. Aslam, and V. P. Dravid, *Appl. Phys. Lett,* **84(5)** (2004), 828-830.
4. **Transport of Organic Solutes through Amorphous Teflon AF Films,** H. Zhao, N. Q. Wu, X. Zhang, K. Crowley, S. G. Weber, *J. Am. Chem. Soc*., (accepted, 2005).
5. **Crystalline boron nanoribbons: synthesis and characterization,** T. T. Xu, J-G. Zheng, N. Q. Wu, A. W. Nicholls, J. R. Roth, D. A. Dikin, R. S. Ruoff, *Nano letters*, **4** (2004), 963-968.

B. OTHER SIGNIFICANT PUBLICATIONS

6. **Impedance-metric Pt/YSZ/Au-Ga_2O_3 sensors for CO detection at high-temperature,** N. Q. Wu, Z. Chen, J. Xu, M. Chyu, S. X. Mao, *Sensors & Actuators B*, (In press, 2005)
7. **Effect of N_2 flow rate on morphology and structure of ZnO nanocrystals synthesized via vapor deposition,** Z. Chen, N.Q. Wu Z. Shan, M. Zhao, S. Li, C. B. Jiang, S. X. Mao, *Scripta Materialia,* **52** (2005) 63-67.

8. **Dip-pen nanopatterning of photosensitive conducting polymer using a monomer ink,** M. Su, M. Aslam, L. Fu, N. Q. Wu, and V. P. Dravid, *Appl. Phys. Lett,* **84(21)** (2004), 4200-4202.
9. **Synthesis and characterization of MCM-41–supported Ba_2SiO_4 base catalyst,** Q. C. Li, S. E. Brown, L. J. Broadbelt, J-G. Zheng, N. Q. Wu, *Microporous and Mesoporous Materials,* **59(2-3)** (2003), 105-111.
10. **Hot corrosion mechanism of composite alumina/yttria-stabilized zirconia coating in molten sulfate-vanadate salt,** N.Q. Wu, Z. Chen and S. X. Mao, *J. Am. Ceram. Soc.*, **88(3)** (2005), 675-682.

IV. Synergistic Activities

- Member, Materials Research Society, American Vacuum Society,
- Journal reviewer for "Journal of crystal growth" and "Materials Letters",
- Proposal reviewer for Department of Energy (DOE),
- Member, WVNano initiative.

V. Collaborators and Other Affiliations

A. Collaborators and Co-Editors

Vinayak Dravid, Northwestern University; Uwe H. Hömmerich, Hampton University; Harold Kung, Northwestern University; Scott X. Mao, University of Pittsburgh; Rod Ruoff, Northwestern University; Ming Su, ONL; Jayne Wu, University of Tennessee;

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Higher Education Policy Commission

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Paul L Hill

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Paul L Hill - PI**	**6.00**	**0.00**	**0.00**	$ **56,350**	$
2. **Jan Taylor - Co-PI**	**6.00**	**0.00**	**0.00**	**40,150**	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	**12.00**	**0.00**	**0.00**	**96,500**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**96,500**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**17,528**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**114,028**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**68,000**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**2,751,222**	
6. OTHER				**50,150**	
TOTAL OTHER DIRECT COSTS				**2,869,372**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**2,983,400**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **3 subawards (1st 25,000 each) (Rate: 5.4000, Base: 75000) (Cont. on Comments Page)**					
TOTAL INDIRECT COSTS (F&A)				**16,588**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**2,999,988**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **2,999,988**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Paul L Hill

ORG. REP. NAME*
Terry hess

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

**** I- Indirect Costs**
direct costs minus subawards & equip (Rate: 5.4000, Base 232178)

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Higher Education Policy Commission

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Paul L Hill

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Paul L Hill - PI**	**6.00**	**0.00**	**0.00**	$ **58,058**	$
2. **Jan Taylor - Co-PI**	**6.00**	**0.00**	**0.00**	**41,375**	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	**12.00**	**0.00**	**0.00**	**99,433**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**99,433**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**17,945**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**117,378**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**68,000**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**2,753,919**	
6. OTHER				**48,050**	
TOTAL OTHER DIRECT COSTS				**2,869,969**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**2,987,347**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **direct costs minus subawards & equipment (Rate: 5.4000, Base: 233428)**					
TOTAL INDIRECT COSTS (F&A)				**12,605**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**2,999,952**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **2,999,952**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Paul L Hill

ORG. REP. NAME*
Terry hess

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Higher Education Policy Commission

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Paul L Hill

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Paul L Hill - PI**	**6.00**	**0.00**	**0.00**	$ **59,817**	$
2. **Jan Taylor - Co-PI**	**6.00**	**0.00**	**0.00**	**42,636**	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	**12.00**	**0.00**	**0.00**	**102,453**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**102,453**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**18,374**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**120,827**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**68,000**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**2,752,508**	
6. OTHER				**45,950**	
TOTAL OTHER DIRECT COSTS				**2,866,458**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**2,987,285**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **direct costs minus subawards & equipment (Rate: 5.4000, Base: 234777)**					
TOTAL INDIRECT COSTS (F&A)				**12,678**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**2,999,963**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **2,999,963**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Paul L Hill

ORG. REP. NAME*
Terry hess

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION: **Higher Education Policy Commission**

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR: **Paul L Hill**

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Paul L Hill - PI**	**18.00**	**0.00**	**0.00**	$ **174,225**	$
2. **Jan Taylor - Co-PI**	**18.00**	**0.00**	**0.00**	**124,161**	
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	**36.00**	**0.00**	**0.00**	**298,386**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**298,386**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**53,847**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**352,233**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**204,000**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**8,257,649**	
6. OTHER				**144,150**	
TOTAL OTHER DIRECT COSTS				**8,605,799**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**8,958,032**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**41,871**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**8,999,903**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **8,999,903**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME: **Paul L Hill**

ORG. REP. NAME*: **Terry hess**

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

WV HIGHER EDUCATION POLICY COMMISSION BUDGET JUSTIFICATION

YEAR 1

A. SENIOR PERSONNEL

Primary Researcher Paul Hill and Co-PI Jan Taylor will commit 75% of their time to this project of which 6 months ($96,500) is requested from NSF and 3 months ($48,250) will be paid with State funds.

B. OTHER PERSONNEL

No NSF funds are requested. Support staff, including the Program Administrator, to be funded 100% with state funds.

C. FRINGE BENEFITS

Fringe benefits calculated at actual costs for all full-time regular positions. NSF funds requested = $17,528; State support = $8,764.

D. Equipment

No NSF funds requested. Office equipment upgrades will be purchased with state funds in the amount of $1,500.

E. TRAVEL

No NSF funds requested. Travel for PIs, staff, faculty, council, external reviewers and special guests will be paid for with state funds in the amount of $30,000.

G. OTHER DIRECT COSTS

1. Materials & Supplies

Supplies (defined as items that are normally used in the operation of an office and primarily consider expendable in nature such as letterhead, paper, toner, pens, magazine subscriptions, etc.,) will be purchased with state funds. No NSF funds are requested.

2. Publications

WVEPSCoR has committed $100,000 for a communications plan to be funded with state funds. No NSF funds are requested.

3. Consultant Services

Funds for consulting services for program evaluation and technical services are requested from NSF in the amount of $68,000 matched by $40,000 of state funds.

4. Computer Services

Computer services for statistical analysis packages to augment the HELIX Web Engine (an on-line database containing quantitative indicators of program performance) will be funded with state dollars in the amount of $80,000.

5. Subawards

Subawards totaling $2,751,198 are requested from NSF for our 3 partner institutions and will be distributed as follows: WVU = $1,962,933; MU = $559,997; WVSU = $228,288. Substantial state and institutional funds will supplement these awards. Each subawardee has provided individual justifications sheets.

6. Other:

$75,000 will be dedicated for technical assistance for support to individual investigators developing proposals, advice and guidance on project implementation, and hosting of external reviews by peer professionals. Of this amount, $50,150 is requested from NSF with an additional $24,850 provided by the state.

Office rental expenses estimated at $35,000 will be provided with state funding.

I. INDIRECT COSTS

Indirect costs are requested in the amount of $16,588. Indirect costs are calculated at 5.4% of modified direct costs. Modified direct costs are total costs less equipment and 5.4% of the first $25,000 of the sub-awards. The 5.4% rate is the negotiated rate with the US Department of Health and Human Services. The date of the agreement with DHHS is 3/27/03 and is in effect until amended.

YEAR 2
Same as Year 1 with noted changes below.

A. SENIOR PERSONNEL
Same as Year 1 (includes 3% pay increase)

5. Subawards
Subawards totaling $2,753,915 are requested from NSF for our 3 partner institutions and will be distributed as follows: WVU = $1,963,456; MU = $559,996; WVSU = $230,463. Substantial state and institutional funds will supplement these awards. Each subawardee has provided individual justifications sheets.

6. Other:
$75,000 will be dedicated for technical assistance for support to individual investigators developing proposals, advice and guidance on project implementation, and hosting of external reviews by peer professionals. Of this amount, $48,050 is requested from NSF with an additional $26,950 provided by the state.

I. INDIRECT COSTS
Indirect costs are requested in the amount of $12,605. Indirect costs are calculated at 5.4% of modified direct costs. Modified direct costs are total costs less equipment and sub-awards. The 5.4% rate is the negotiated rate with the US Department of Health and Human Services. The date of the agreement with DHHS is 3/27/03 and is in effect until amended.

YEAR 3
Same as Year 2 with noted changes below.

A. SENIOR PERSONNEL
Same as Year 2 (includes 3% pay increase)

5. Subawards
Subawards totaling $2,752,506 are requested from NSF for our 3 partner institutions and will be distributed as follows: WVU = $1,959,810; MU = $559,994; WVSU = $232,702. Substantial state and institutional funds will supplement these awards. Each subawardee has provided individual justifications sheets.

6. Other:
$75,000 will be dedicated for technical assistance for support to individual investigators developing proposals, advice and guidance on project implementation, and hosting of external reviews by peer professionals. Of this amount, $45,950 is requested from NSF with an additional $29,050 provided by the state.

I. INDIRECT COSTS
Indirect costs are requested in the amount of $12,678. Indirect costs are calculated at 5.4% of modified direct costs. Modified direct costs are total costs less equipment and sub-awards. The 5.4% rate is the negotiated rate with the US Department of Health and Human Services. The date of the agreement with DHHS is 3/27/03 and is in effect until amended.

SUMMARY PROPOSAL BUDGET YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION: **Marshall University Research Corporation**

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR: **Louis H Aulick**

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Louis H Aulick - Co-PI**	0.00	0.00	0.00	$ 0	$
2. **Eric Blough - Faculty**	0.00	1.08	2.00	10,190	
3. **Philippe Georgel - Faculty**	0.00	1.08	2.00	11,190	
4. **Marcia Harrison - Faculty**	0.00	0.00	1.00	6,350	
5. **Jaroslava Miksovska - Faculty**	0.00	1.08	2.00	11,111	
6. (**1**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	8.00	0.00	47,273	
7. (**6**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	11.24	7.00	86,114	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**5**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	13,275	
3. (**0**) GRADUATE STUDENTS				0	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				99,389	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				29,817	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				129,206	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) **ProteomeLab XL-A Protein Characterization System** $ 150,000					
TOTAL EQUIPMENT				150,000	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				36,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				127,652	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				127,652	
H. TOTAL DIRECT COSTS (A THROUGH G)				442,858	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **total direct costs minus tuition & equipment (Rate: 40.0000, Base: 292858)**					
TOTAL INDIRECT COSTS (F&A)				117,143	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				560,001	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 560,001	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME: **Louis H Aulick**

ORG. REP. NAME*: **Terry hess**

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
New Hire, - - Faculty Researcher	0.00	8.00	0.00	47273

SUMMARY PROPOSAL BUDGET YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Marshall University Research Corporation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Louis H Aulick

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Louis H Aulick - Co-PI**	0.00	0.00	0.00	$ 0	$
2. **Eric Blough - Faculty**	0.00	1.08	2.00	10,496	
3. **Philippe Georgel - Faculty**	0.00	1.08	2.00	11,526	
4. **Marcia Harrison - Faculty**	0.00	0.00	1.00	6,541	
5. **Jaroslava Miksovska - Faculty**	0.00	1.08	2.00	11,444	
6. (**1**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	9.00	1.75	66,950	
7. (**6**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	12.24	8.75	106,957	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**5**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	13,674	
3. (**0**) GRADUATE STUDENTS				0	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				120,631	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				36,189	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				156,820	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				36,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				207,180	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				207,180	
H. TOTAL DIRECT COSTS (A THROUGH G)				400,000	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **total direct costs minus tuition & equipment (Rate: 40.0000, Base: 400000)**					
TOTAL INDIRECT COSTS (F&A)				160,000	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				560,000	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 560,000	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Louis H Aulick

ORG. REP. NAME*
Terry hess

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 2

Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
New Hire, - - Faculty Researcher	0.00	9.00	1.75	66950

SUMMARY PROPOSAL BUDGET YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Marshall University Research Corporation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Louis H Aulick

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Louis H Aulick - Co-PI**	0.00	0.00	0.00	$ 0	$
2. **Eric Blough - Faculty**	0.00	1.08	2.00	10,811	
3. **Philippe Georgel - Faculty**	0.00	1.08	2.00	11,871	
4. **Marcia Harrison - Faculty**	0.00	0.00	1.00	6,737	
5. **Jaroslava Miksovska - Faculty**	0.00	1.08	2.00	11,788	
6. (**1**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	4.00	0.00	25,076	
7. (**6**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	7.24	7.00	66,283	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**5**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	14,082	
3. (**1**) GRADUATE STUDENTS				21,700	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				102,065	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				24,342	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				126,407	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				36,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				237,590	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				237,590	
H. TOTAL DIRECT COSTS (A THROUGH G)				399,997	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **total direct costs minus tuition & equipment (Rate: 40.0000, Base: 399997)**					
TOTAL INDIRECT COSTS (F&A)				159,999	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				559,996	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 559,996	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Louis H Aulick

ORG. REP. NAME*
Terry hess

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Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 3

Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
New Hire, - - Faculty Researcher	0.00	4.00	0.00	25076

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION: **Marshall University Research Corporation**

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR: **Louis H Aulick**

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Louis H Aulick - Co-PI**	0.00	0.00	0.00	$ 0	$
2. **Eric Blough - Faculty**	0.00	3.24	6.00	31,497	
3. **Philippe Georgel - Faculty**	0.00	3.24	6.00	34,587	
4. **Marcia Harrison - Faculty**	0.00	0.00	3.00	19,628	
5. **Jaroslava Miksovska - Faculty**	0.00	3.24	6.00	34,343	
6. (1) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	21.00	1.75	139,299	
7. (6) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	30.72	22.75	259,354	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (0) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (15) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	41,031	
3. (1) GRADUATE STUDENTS				21,700	
4. (0) UNDERGRADUATE STUDENTS				0	
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (0) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				322,085	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				90,348	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				412,433	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) $ 150,000					
TOTAL EQUIPMENT				150,000	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				108,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (0) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				572,422	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				572,422	
H. TOTAL DIRECT COSTS (A THROUGH G)				1,242,855	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				437,142	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				1,679,997	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 1,679,997	$

M. COST SHARING PROPOSED LEVEL $ 0 AGREED LEVEL IF DIFFERENT $

PI/PD NAME: **Louis H Aulick**

ORG. REP. NAME*: **Terry hess**

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

BUDGET JUSTIFICATION – MARSHALL UNIVERSITY

A. SENIOR PERSONNEL

1. **Co-PI** – Howard Aulick (Ph.D., VP for Research, MU EPSCoR Coordinator) will designate 10% of his time to the project. All funds ($10,000/yr) are in-kind salary match. His responsibilities include oversight of all MU administrative components of this project.
2. **Researcher** – Eric Blough (Ph.D., assistant professor, Biology) will devote 100% summer effort and 12% academic effort per year to the project. $10,190 is requested for two months of summer support in each year. A 3% raise is budgeted for Y2 and Y3. His academic salary support ($5,503 = 12% 9-month salary) will be from university in-kind matching funds. His responsibilities are to conduct research and train students in molecular transport.
3. **Researcher** – Philippe Georgel (Ph.D., assistant professor, Biology) will devote 100% summer effort and 12% academic effort per year to the project. $ 11,190 is requested for two months of summer support in each year. A 3% raise is budgeted for Y2 and Y3. His academic salary support ($6,043 = 12% 9-month salary) will be from the university in-kind matching funds. His responsibilities are to conduct research and train students in chromatin structure and function.
4. **Researcher** – Jaroslava Miksovska (Ph.D., assistant professor, Chemistry) will devote 100% summer effort and 12% academic effort per year to the project. $11,111 is requested for two months of summer support in each year. A 3% raise is budgeted for Y2 and Y3. Her academic salary support ($6,000 = 12% 9-month salary) will be from the university in-kind matching funds. Her responsibilities are to conduct research and train students in P450 enzyme structure and function
5. **Outreach** - Marcia Harrison (Ph.D., professor, Biology) will devote 10% overall effort to the project with 100% effort requested for one summer months. $6,350 is requested for Y1 with a 3% raise for Y2 and Y3. Her responsibilities will be to coordinate university outreach programs with WVU, WVSU and other WV colleges.
6. **New Hire (TBA)** - A new tenure-track associate professor will be hired in fall 2006 and devote 100% effort to the project. Eight months of an academic yearly salary is requested in Y1 at $47,273. Nine months academic salary in Y2 ($66,950) includes a 3% raise plus seven weeks of summer support. Y3 salary, at $25,076, is for an anticipated 4 months with the university contributing the remaining funds and subsequently adding full support as a permanent position. His/her responsibility will be research, student training and junior faculty mentorship.
7. **Researcher** – Michael Norton (Ph.D., professor, Chemistry) will devote 15% effort to the project. His salary (9,308 = 15% 9-month salary) is provided by university in-kind matching funds. His responsibilities will be 2-D DNA arrays research, graduate training, post doctoral supervision and junior faculty mentoring.
8. **Researcher** - Huong Nguyen (Ph.D., assistant professor, Physics) will devote 100% summer effort and 12% academic effort per year to the project. Her salary for two summer months ($11,554 plus 3% raises in Y2 and Y3) will be provided as university cash match. Her academic salary support ($6,240 = 12% of 9-month salary plus 3% raises in Y2 and Y3) will be provided from the university in-kind matching funds. Her responsibilities will be calculating the influence of particle structure and composition on nanoparticle luminescence lifetime.
9. **Researcher (TBA)** – A senior scientist will be in place by fall 2006 as the Institute of Interdisciplinary Research Director (IIR). His/her salary ($130,000/yr) and start-up ($600,000) will be provided as a cash match by MU. His/her primary responsibility for this project will be cell division and differentiation research, graduate student training and junior faculty mentorship.

10. **Teaching Faculty** – 2 full-time temporary faculty members will be provide release time from teaching responsibilities of RII faculty. Their $36,000/acad.yr salaries (plus 3% raises in Y2 and Y3) will be provided as a cash match by MU.

B. OTHER PERSONNEL

1. **Post Doctoral Associates** – 2 post doctoral associates will be hired to support this project. Their salaries ($36,000/yr plus 3% raises in Y2 and Y3) will be provided as cash match by state Research Challenge Fund (RCF).
2. **Research Technicians** – 3 technicians (Hagerman, Rice and TBA) will devote 15% effort to this project. They will assist RII faculty (Blough, Georgel, and Miksovska). $4,425 is requested for salary for each technician plus 3% raises in Y2 and Y3.
3. **Teaching Assistants -** $90,000/yr is provided each year as a cash match by the university and RCF to support 10 TAs. These master's students are provided to support the release time for RII faculty.
4. **Graduate Students** – three PhD student stipends at $21,700/yr each will be provided as cash match by state RCF. State RCF will provide another stipend in Y2 and Y3 for IIR Director. A fifth stipend at $21,700/yr is requested from NSF in Y3 for the new research hire. All stipends will be continued by MU and RCF after RII ends.
5. **Undergraduate Students** – the cost of undergraduate research will be provided by MU in-kind match.
6. **Secretarial** – H. Williams will provide secretarial support for the RII. Her $26,780/yr salary (plus 3% raises in Y2 and Y3) will be provided as cash match by MU.

C. FRINGE BENEFITS

MU's fringe benefit rates are 30% for all full-time regular positions, 12% for undergraduates and temporary employees, and 1.07% for graduate assistants.

D. EQUIPMENT

$150,000 is requested in Y1 to purchase a ProteomeLab XL-A Protein Characterization System with Scanning UV visible optics. Dr. Georgel will be the principal user of this equipment in characterization of chromatin structure and function. MU cash match of $25,000 will be required to complete this purchase.

E. DOMESTIC TRAVEL

1. **Faculty Travel Grants** – $10,000 is requested each year to support competitive travel grants of up to $2,000 each for RII faculty researchers. This travel will support presentation of research papers at national meetings and/or workshops that advance our work in molecular recognition and transport.
2. **Student Travel Grants** – $10,000 is requested each year for competitive travel grants - up to $2,000 each for RII graduate student researchers.
3. **Visiting Scholars Travel** - $10,000 is requested annually for travel of senior scientists in research fields of RII faculty. These scholars will be asked to give a paper plus assess research progress and proposal preparation of RII faculty and post doctoral associates.
4. **Travel to WVU** - $6,000 is requested each year to cover costs of RII faculty, post doctoral associates, technical staff and students travel to WVU. The purpose of this travel will be to attend grant writing workshops, joint training exercises, and/or participate in collaborative research experiments. Estimates are based on anticipated ground transportation costs, plus lodging, registration fees, and per diem.

G. OTHER DIRECT COSTS

1. **Start-up Funds** – A 3-year total of $356,000 is requested for expenses accrued as start-up for new faculty researcher. An additional $44,000 will be provided as cash match from the state RCF.
2. **Laboratory Supplies** – A 3-year total of $165,172 is requested for research supplies for four RII junior faculty members (Blough, Georgel, Nguyen and Miksovska). An additional $26,115 will be provided as cash match from the state RCF.
3. **Equipment Maintenance** - $30,000 ($10,000/yr) will be provided as cash match by MU to cover maintenance of the ProteomeLab XL-A Protein Characterization System.
4. **Seed Grants** - $15,000 is requested in Y2 and Y3 for competitive seed grants for MU faculty. An additional $9,620 will be provided cash match from RCF. These $2,000-$5,000 awards will cover the supply costs of pilot studies at the nano-bio interface in molecular recognition and transport.
5. **Grantsmanship Program** – $5,000 is requested each year to cover the costs (registration, materials, etc.) of MU grant development workshops and outside reviews of grant proposals incurred by RII faculty, post doctoral fellows.
6. **Graduate Student Recruitment** – A total of $6,250 is requested to cover PhD student recruiting costs for RII faculty in Y2 and Y3; and additional $815 will be provided as cash match from state RCF match, and another $15,435 from MU's cash match.
7. **Tuition Waivers** - $60,895 will be provided as MU in-kind match from fall 2006 through spring 2009. This includes $3205/student/semester for 3 students in fall 2006, 3 students in the spring of 2007, 4 students in the fall of 2007, 4 students in the spring of 2008, 4 students in the fall 2008, and 5 students in the spring 2009.
8. **Publications** – A 3-year total of $4,500 will be provided a cash match from state RCF to cover the cost of publications and printing.
9. **Technology Fees** – MU will provide $10,500 over three years to cover the technology costs (IT, MU and WVU core lab fees, etc.) of RII investigators.
10. **MU EPSCoR Office** – MU will provide an estimated $1,000/yr as in-kind match to cover the operational costs of the EPSCoR Office.

I. INDIRECT COSTS

Indirect costs are calculated at 40% of modified total direct costs. The 40% rate is Marshall University's federally negotiated rate with the US Department of Health and Human Services. The date of the agreement with DHHS is 05/11/04.

SUMMARY PROPOSAL BUDGET

YEAR 1

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PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION: **West Virginia State College**

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR: **A Joseph Kusimo**

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **A Joseph Kusimo - CASTEM Director**	5.00	0.00	0.00	$ 25,000	$
2.					
3.					
4.					
5.					
6. (0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (1) TOTAL SENIOR PERSONNEL (1 - 6)	5.00	0.00	0.00	25,000	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (0) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (1) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	5.50	0.00	0.00	16,000	
3. (0) GRADUATE STUDENTS				0	
4. (0) UNDERGRADUATE STUDENTS				0	
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (4) OTHER				15,000	
TOTAL SALARIES AND WAGES (A + B)				56,000	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				16,800	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				72,800	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				0	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 50,000					
2. TRAVEL 6,780					
3. SUBSISTENCE 0					
4. OTHER 40,000					
TOTAL NUMBER OF PARTICIPANTS (60) TOTAL PARTICIPANT COSTS				96,780	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				7,500	
5. SUBAWARDS				0	
6. OTHER				25,000	
TOTAL OTHER DIRECT COSTS				32,500	
H. TOTAL DIRECT COSTS (A THROUGH G)				202,080	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **salaries and fringes (Rate: 36.0000, Base: 72800)**					
TOTAL INDIRECT COSTS (F&A)				26,208	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				228,288	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 228,288	$

M. COST SHARING PROPOSED LEVEL $ 0 AGREED LEVEL IF DIFFERENT $

PI/PD NAME: **A Joseph Kusimo**

ORG. REP. NAME*: **Terry hess**

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
West Virginia State College

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
A Joseph Kusimo

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **A Joseph Kusimo - CASTEM Director**	5.00	0.00	0.00	$ 25,750	$
2.					
3.					
4.					
5.					
6. (0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (1) TOTAL SENIOR PERSONNEL (1 - 6)	5.00	0.00	0.00	25,750	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (0) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (1) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	5.50	0.00	0.00	16,480	
3. (0) GRADUATE STUDENTS				0	
4. (0) UNDERGRADUATE STUDENTS				0	
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (4) OTHER				15,000	
TOTAL SALARIES AND WAGES (A + B)				57,230	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				17,169	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				74,399	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				0	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 50,000					
2. TRAVEL 6,780					
3. SUBSISTENCE 0					
4. OTHER 40,000					
TOTAL NUMBER OF PARTICIPANTS (60) TOTAL PARTICIPANT COSTS				96,780	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				7,500	
5. SUBAWARDS				0	
6. OTHER				25,000	
TOTAL OTHER DIRECT COSTS				32,500	
H. TOTAL DIRECT COSTS (A THROUGH G)				203,679	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **salaries and fringes (Rate: 36.0000, Base: 74399)**					
TOTAL INDIRECT COSTS (F&A)				26,784	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				230,463	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 230,463	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
A Joseph Kusimo

ORG. REP. NAME*
Terry hess

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
West Virginia State College

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
A Joseph Kusimo

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **A Joseph Kusimo - CASTEM Director**	5.00	0.00	0.00	$ 26,523	$
2.					
3.					
4.					
5.					
6. (0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (1) TOTAL SENIOR PERSONNEL (1 - 6)	5.00	0.00	0.00	26,523	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (0) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (1) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	5.50	0.00	0.00	16,974	
3. (0) GRADUATE STUDENTS				0	
4. (0) UNDERGRADUATE STUDENTS				0	
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (4) OTHER				15,000	
TOTAL SALARIES AND WAGES (A + B)				58,497	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				17,549	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				76,046	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				0	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 50,000					
2. TRAVEL 6,780					
3. SUBSISTENCE 0					
4. OTHER 40,000					
TOTAL NUMBER OF PARTICIPANTS (60) TOTAL PARTICIPANT COSTS				96,780	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				7,500	
5. SUBAWARDS				0	
6. OTHER				25,000	
TOTAL OTHER DIRECT COSTS				32,500	
H. TOTAL DIRECT COSTS (A THROUGH G)				205,326	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **salaries and fringes (Rate: 36.0000, Base: 76045)**					
TOTAL INDIRECT COSTS (F&A)				27,376	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				232,702	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 232,702	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
A Joseph Kusimo

ORG. REP. NAME*
Terry hess

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

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PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION: **West Virginia State College**

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR: **A Joseph Kusimo**

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **A Joseph Kusimo - CASTEM Director**	15.00	0.00	0.00	$ 77,273	$
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (1) TOTAL SENIOR PERSONNEL (1 - 6)	15.00	0.00	0.00	77,273	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (0) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (3) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	16.50	0.00	0.00	49,454	
3. (0) GRADUATE STUDENTS				0	
4. (0) UNDERGRADUATE STUDENTS				0	
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (12) OTHER				45,000	
TOTAL SALARIES AND WAGES (A + B)				171,727	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				51,518	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				223,245	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				0	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 150,000					
2. TRAVEL 20,340					
3. SUBSISTENCE 0					
4. OTHER 120,000					
TOTAL NUMBER OF PARTICIPANTS (180) TOTAL PARTICIPANT COSTS				290,340	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				22,500	
5. SUBAWARDS				0	
6. OTHER				75,000	
TOTAL OTHER DIRECT COSTS				97,500	
H. TOTAL DIRECT COSTS (A THROUGH G)				611,085	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				80,368	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				691,453	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 691,453	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME: **A Joseph Kusimo**

ORG. REP. NAME*: **Terry hess**

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Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

WEST VIRGINIA STATE UNIVERSITY BUDGET JUSTIFICATION

YEAR 1

A. SENIOR PERSONNEL

Primary Researcher (CASTEM Director) Joseph Kusimo is requesting 5 months of his salary from NSF in the amount of $25,000. State and institutional funding will cover 5% ($4,420) of time for the Associate Director for Research, a total of 10% ($13,600) of the time of Extension staff (Associate Director for Extension and Youth Education Extension Specialist) and 5% ($20,000) of time for 8 STEM Faculty.

B. OTHER PERSONNEL

$15,000 is requested from NSF for summer support for faculty pursuing professional interests in biometrics. $16,000 is requested for a STEM Coordinator who will also serve as an outreach and research coordinator; an additional $19,000 will be provided with state and institutional support to fund this position at 100%.

C. FRINGE BENEFITS

Fringe benefits calculated at 30% for all NSF funded positions for a total of $16,800. Fringes at the same rate will be provided with state support for the research coordinator position ($5,700).

F. PARTICIPANT SUPPORT

$50,000 is requested for retention initiatives for undergraduates in STEM. Another $6,780 is requested for student travel. $40,000 is requested for a freshman minority student outreach program (SURE) for approximately 30-40 students.

G. OTHER DIRECT COSTS

1. Materials & Supplies

Supplies (defined as items that are normally used in the operation of an office and primarily consider expendable in nature such as letterhead, paper, toner, pens, magazine subscriptions, etc.,) will be purchased with state and institutional funds in the amount of $12,300.

4. Computer Services

Subscription to the John Hopkin's COS system is requested in the amount of $7,500 to assist in research funding opportunities.

6. Other:

$25,000 is requested from NSF for faculty professional development. An additional $18,000 will be provided with institutional support for office space.

I. INDIRECT COSTS

Indirect costs are requested in the amount of $26,208. Indirect costs are calculated at 30% of salaries and benefits.

YEAR 2

A. SENIOR PERSONNEL

Primary Researcher (CASTEM Director) Joseph Kusimo is requesting 5 months of his salary from NSF in the amount of $25,750 (a 3% increase from Year 1). All other items are the same as Year 1.

B. OTHER PERSONNEL

$16,480 is requested for a STEM Coordinator; all other items are the same as Year 1.

C. FRINGE BENEFITS

Fringe benefits calculated at 30% for all NSF funded positions for a total of $17,169.

F. PARTICIPANT SUPPORT

Same as Year 1.

G. OTHER DIRECT COSTS

Same as Year 1.

I. INDIRECT COSTS
Indirect costs are requested in the amount of $26,784. Indirect costs are calculated at 30% of salaries and benefits.

YEAR 3

A. SENIOR PERSONNEL
Primary Researcher (CASTEM Director) Joseph Kusimo is requesting 5 months of his salary from NSF in the amount of $26523 (a 3% increase from Year 2). All other items are the same as Year 1.

B. OTHER PERSONNEL
$16,974 is requested for a STEM Coordinator; all other items are the same as Year 1.

C. FRINGE BENEFITS
Fringe benefits calculated at 30% for all NSF funded positions for a total of $17,549.

F. PARTICIPANT SUPPORT
Same as Year 1.

G. OTHER DIRECT COSTS

Same as Year 1.

I. INDIRECT COSTS
Indirect costs are requested in the amount of $27,376. Indirect costs are calculated at 30% of salaries and benefits.

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
West Virginia University Research Corporation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Curt M Peterson

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Curt M Peterson - Co-PI, Coordinator**	1.80	0.00	0.00	$ 0	$
2. **Phyllis Barnhart - Assoc. Dir, WVNano**	6.75	0.00	0.00	60,750	
3. **Richard Carroll - Nano-bio Device Expert**	0.00	4.50	1.00	38,133	
4. **Lawrence A Hornak - Co-PI, Technical**	0.00	0.00	0.00	0	
5. **- New Hire 1 - Surface Modification Chemist**	0.00	9.00	1.00	73,000	
6. (**5**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	40.50	5.00	337,124	
7. (**10**) TOTAL SENIOR PERSONNEL (1 - 6)	8.55	54.00	7.00	509,007	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**3**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	107,500	
3. (**8**) GRADUATE STUDENTS				192,000	
4. (**8**) UNDERGRADUATE STUDENTS				40,000	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				848,507	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				179,484	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				1,027,991	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				16,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 148,629					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**66**) TOTAL PARTICIPANT COSTS				148,629	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				170,442	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				14,000	
3. CONSULTANT SERVICES				10,000	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				194,442	
H. TOTAL DIRECT COSTS (A THROUGH G)				1,387,062	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **salaries/benefits, travel, other direct costs (Rate: 46.5000, Base: 1238433)**					
TOTAL INDIRECT COSTS (F&A)				575,871	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				1,962,933	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 1,962,933	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Curt M Peterson

ORG. REP. NAME*
Terry hess

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Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
New Hire 2, - - Optical Spectroscopist	0.00	9.00	1.00	73000
New Hire 3, - - Nano-Fabrication Expert	0.00	9.00	1.00	73000
New Hlre 4, - - Structural Biologist/Biophysic	0.00	9.00	1.00	73000
New Hire 5, - - Theoretical Nanoscientist	0.00	9.00	1.00	73000
Wu, N - Nanoscale Imaging & Char Scien	0.00	4.50	1.00	45124

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
West Virginia University Research Corporation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Curt M Peterson

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Curt M Peterson - Co-PI, Coordinator**	0.00	0.00	0.00	$ 0	$
2. **Phyllis Barnhart - Assoc. Dir, WVNano**	0.00	4.50	2.50	63,180	
3. **Richard Carroll - Nano-bio Device Expert**	0.00	0.00	1.00	6,933	
4. **Lawrence A Hornak - Co-PI, Technical**	0.00	0.00	0.00	0	
5. **- New Hire 1 - Surface Modification Chemist**	0.00	4.50	1.00	46,396	
6. (**8**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	45.00	8.00	421,788	
7. (**13**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	54.00	12.50	538,297	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**3**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	55,900	
3. (**11**) GRADUATE STUDENTS				274,560	
4. (**11**) UNDERGRADUATE STUDENTS				55,000	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				923,757	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				177,573	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				1,101,330	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				16,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 145,114					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**66**) TOTAL PARTICIPANT COSTS				145,114	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				95,000	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				18,859	
3. CONSULTANT SERVICES				10,000	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				123,859	
H. TOTAL DIRECT COSTS (A THROUGH G)				1,386,303	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **salaries/benefits, travel, other direct costs (Rate: 46.5000, Base: 1241189)**					
TOTAL INDIRECT COSTS (F&A)				577,153	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				1,963,456	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 1,963,456	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Curt M Peterson

ORG. REP. NAME*
Terry hess

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Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 2

Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
New Hire 2, - - Optical Spectroscopist	0.00	4.50	1.00	46396
New Hire 3, - - Nano-Fabrication Expert	0.00	4.50	1.00	46396
New Hlre 4, - - Structural Biologist/Biophysic	0.00	4.50	1.00	46396
New Hire 5, - - Theoretical Nanoscientist	0.00	4.50	1.00	46396
New Hire 6, - - Nano-Electrical-Mech Sys Expt	0.00	9.00	1.00	76000
New Hire 7, - - Supramolecular Chemist	0.00	9.00	1.00	76000
New Hire 8, - - Science Educator	0.00	9.00	1.00	76000
Wu, N - Nanoscale Imaging & Char Scien	0.00	0.00	1.00	8204

SUMMARY PROPOSAL BUDGET YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
West Virginia University Research Corporation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Curt M Peterson

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Curt M Peterson - Co-PI, Coordinator**	0.00	0.00	0.00	$ 0	$
2. **Phyllis Barnhart - Assoc. Dir, WVNano**	0.00	4.50	2.50	65,707	
3. **Richard Carroll - Nano-bio Device Expert**	0.00	0.00	1.00	7,211	
4. **Lawrence A Hornak - Co-PI, Technical**	0.00	0.00	0.00	0	
5. **- New Hire 1 - Surface Modification Chemist**	0.00	4.50	1.00	48,251	
6. (**8**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	31.50	8.00	346,443	
7. (**13**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	40.50	12.50	467,612	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**3**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	58,136	
3. (**11**) GRADUATE STUDENTS				285,542	
4. (**11**) UNDERGRADUATE STUDENTS				55,000	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				866,290	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				159,266	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				1,025,556	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
ABAI Automated DNA Synthesizer $ 26,180					
TOTAL EQUIPMENT				26,180	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				16,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 137,282					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**66**) TOTAL PARTICIPANT COSTS				137,282	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				152,620	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				22,000	
3. CONSULTANT SERVICES				10,000	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				184,620	
H. TOTAL DIRECT COSTS (A THROUGH G)				1,389,638	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
salaries/benefits, travel, other direct costs (Rate: 46.5000, Base: 1226176)					
TOTAL INDIRECT COSTS (F&A)				570,172	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				1,959,810	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 1,959,810	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Curt M Peterson

ORG. REP. NAME*
Terry hess

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 3

Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
New Hire 2, - - Optical Spectroscopist	0.00	4.50	1.00	48251
New Hire 3, - - Nano-Fabrication Expert	0.00	4.50	1.00	48251
New Hlre 4, - - Structural Biologist/Biophysic	0.00	4.50	1.00	48251
New Hire 5, - - Theoretical Nanoscientist	0.00	4.50	1.00	48251
New Hire 6, - - Nano-Electrical-Mech Sys Expt	0.00	4.50	1.00	48302
New Hire 7, - - Supramolecular Chemist	0.00	4.50	1.00	48302
New Hire 8, - - Science Educator	0.00	4.50	1.00	48302
Wu, N - Nanoscale Imaging & Char Scien	0.00	0.00	1.00	8533

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
West Virginia University Research Corporation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Curt M Peterson

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Curt M Peterson - Co-PI, Coordinator**	1.80	0.00	0.00	$ 0	$
2. **Phyllis Barnhart - Assoc. Dir, WVNano**	6.75	9.00	5.00	189,637	
3. **Richard Carroll - Nano-bio Device Expert**	0.00	4.50	3.00	52,277	
4. **Lawrence A Hornak - Co-PI, Technical**	0.00	0.00	0.00	0	
5. **- New Hire 1 - Surface Modification Chemist**	0.00	18.00	3.00	167,647	
6. (**8**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	117.00	21.00	1,105,355	
7. (**13**) TOTAL SENIOR PERSONNEL (1 - 6)	8.55	148.50	32.00	1,514,916	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**9**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	221,536	
3. (**30**) GRADUATE STUDENTS				752,102	
4. (**30**) UNDERGRADUATE STUDENTS				150,000	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				2,638,554	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				516,323	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				3,154,877	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) $ 26,180					
TOTAL EQUIPMENT				26,180	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				48,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 431,025					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**198**) TOTAL PARTICIPANT COSTS				431,025	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				418,062	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				54,859	
3. CONSULTANT SERVICES				30,000	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				502,921	
H. TOTAL DIRECT COSTS (A THROUGH G)				4,163,003	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				1,723,196	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				5,886,199	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 5,886,199	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Curt M Peterson

ORG. REP. NAME*
Terry hess

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

Budget Justification

A. Senior Personnel. Project administration by Co-PIs Dr. Curt Peterson (1.8 months effort/cal yr) and Dr. Lawrence Hornak (2 months effort/cal yr) will be an in-kind contribution. National Science Foundation (NSF) support is requested for the WVNano Associate Director Barnhart to assist Co-PIs with technical coordination (0.75 months) and to provide science education & human resource development and outreach (EHRDO) supervision and coordination (6.0 months) for the project. ($9K/mon x 6.75 total project months = $60,750 + 27.5% fringe benefits (fb). WVU Research Corporation (WVURC) will provide salary for the remaining calendar year months (5.25 months x $9K/mon = $47,250 + 27.5% fb). WVURC will also provide 9.0 months AY and 3.0 summer months of support for WVNano Director ($12.5K/month x 12 = $150K + 27.5% fb = $191,250). A 4% salary increase/year is assumed for YR 2 and YR 3.

A.6 Other Senior Personnel. New Hires: NSF funds are requested to support salaries and fringe benefits of additional ten new hires over three years at the rate of 100% AY of first year of hire; 50% AY and one summer month salaries thereafter. Salaries assume @ 27.5% fb and 4% increase per year. WVURC funds are committed for remaining 50% AY and two summer months in second and third year of hire. **In YR 1** seven new faculty hires will be supported. Carroll (prorated at $38,133 + 27.5% fb) will provide nano-electro-mechanical expertise to the Molecular Transport Testbed and Nano-kinematic FBBG. Wu (prorated at $45,124 + 27.5% fb) will provide nanoscale imaging and characterization expertise for both testbeds and three of the four FBBGs. WVURC will support remaining AY salaries and two months of summer salaries for Carroll and Wu (total = $98,396 + 27.5% fb). Three of the five remaining new hires will work with both testbeds and all four FBBGs - a Surface Modification (Attachment) Chemist for expertise in the modification of inorganic materials with organic molecules to functionalize systems with molecular/biomolecular recognition elements; an Optical Spectroscopist to perform characterization of nanostructures and devices in ferroelectric, semiconductor and magnetic materials and novel characterization of nanoscale phenomenon occurring at biological/inorganic interfaces in nanostructures; and a Nano-Fabrication expert with state-of-the-art micro- and nano-fabrication techniques for research in biomolecular and biomimetic approaches and the cointegration of biomolecular synthesis and semiconductor fabrication processes. The last two YR 1 hires are a Structural Biologist/Biophysicist for work with Molecular Recognition Testbed and Electronic Transduction FBBG and a theoretical (computational) nanoscientist for work with Molecular Recognition Testbed and the Electonic Transduction FBBG. ($73K average/new hire x 5 new hires = $365K + 27.5% fb) **In YR 2**, NSF support for one month summer salary for Carroll ($6,933 + 27.5% fb) and Wu ($8,204+27.5% fb) is requested. For remaining YR 1 hires, NSF support is requested for 50% AY and one summer month ($46,396 average/hire x 5 hires = $231,980 + 27.5% fb). Requests assume 4% increase per year. WVURC will support remaining AY salaries and two months of summer salaries (total: $696,478 + 27.5% fb). Three new hires of YR 2 include a nano-bio-device expert (works with both testbeds and all four FBBGs), a supramolecular chemist (works with both testbeds and three of the four FBBGs), and a science educator with an emphasis on nanoscience and engineering (NSE) to engage in intellectual collisions with scientists and engineers involved in NSE resulting in collaborations between science teachers and researchers, engagement of pre-college students in research experiences, and dissemination new knowledge on the development of future professionals in a cutting-edge field. ($76K average/new hire x 3 new hires = $228K + 27.5% fb) **In YR 3**, NSF support for one month summer salary for Carroll ($7,211 + 27.5% fb) and Wu ($8,533 +27.5% fb) is requested. For remaining hires, NSF support is requested for 50% AY and one summer month (YR 1 hires: $48,251 average/hire x 5 hires = $241,255 + 27.5% fb and YR 2 hires: $48,302 average/hire x 3 hires = $144,906 + 27.5% fb) Requests assume 4% increase per year. WVURC will support remaining AY salaries and two months of summer salaries (total: $827,153 + 27.5% fb). **Participating Faculty:** WVURC funds ($86K + 27.5 % fb with 4% increase/year for YR 2 and YR 3 + fb) will provide 1.0 month summer salary for 9 Participating Faculty (L. Hornak, T. Myers, B. Edwards, P. Famouri, D. Flynn, P. Gannett, D. Korakakis, D. Lederman, A. Timperman) to serve as technical leaders (0.5 mon) and peer faculty mentors in EHRDO activities (0.5 mon).

Other Personnel:

B.1 Post Doctoral Associates: In YR 2, WVURC will support four Postdoctoral Fellows, one to work with each of the four Functional Building Block Groups (FBBG) ($45K/person x 4 FBBG = $180,000 + 27.5% fb = $229,500 total). RCF will support the four postdoctoral fellows in YR 3 including a 4% salary increase. ($238,680 YR 3 total)

B.2 Other Professionals: NSF funds for Shared Cleanroom Facilities management/maintenance are requested in YR 1 for salaries of Lab Manager ($55K + 27.5% fb) housed in the College of Engineering and Mineral Resources cleanroom; Lab Instrument Mechanic ($35K + 27.5% fb) housed in Eberly College of Arts and Sciences, and Lab

Technician @ 0.5 FTE ($17.5K + 27.5% fb) in Health Science Center-Pharmacy. For YR 2 and YR 3, salaries and fringe benefits support are to be shared equally by NSF and WVURC with transfer of salaries to WVU Colleges/Departments in YR 4. YR 2 and YR 3 assumes 4% increase per year. NSF support requested in YR 2 is $55.9K + 27.5% fb and YR 3 is $58,136 + 27.5 % fb with an equal amount matched in these years by WVURC.
B.3 Graduate Students & B.4 Undergraduate Students: NSF funds are requested for one Graduate Student ($24K + 4.7% fb) and one Undergraduate Student ($5K + 2.3% fb) per new faculty hire and Director for FBBG research in order to accelerate trajectory toward competitiveness. Budget reflects for YR 1 – eight graduate students (8 students x $24K = $192K + 4.7% fb) and eight undergraduate students (8 students x $5K = $40K + 2.3% fb); for YR 2 and YR 3, eleven graduate students ($274,560 and $285,542, respectively + 4.7% fb; assumes a 4 % increase in salary) and eleven undergraduate students ($55,000 + 2.3% per year).
B.5 Secretarial-Clerical: WVURC funds are committed for Administrative Assistant ($30K + 27.5% fb) and secretarial/clerical assistance ($20K + 27.5% fb) for project administration of the technical component and science education & human resource development component. Assistance will be provided to Co-PI/WVU EPSCoR Coordinator, Technical Co-PI; WVNano Director, and Assoc. Director.
D. Equipment: Funds are committed by WVURC and State RCF for purchase of all major pieces of equipment to support the research of the Functional Building Block Groups (FBBG) in YRs 1and 2 and two of the three pieces of equipment in YR 3. Partial support ($26,180) from NSF is needed to purchase remaining equipment. Scheduled purchase of equipment over 3-year project period is coordinated with hiring of new faculty who bring specific expertise to each of the FBBGs. **In YR 1**, the Nanokinematic FBBG requires an inverted fluorescent microscope, Olympus CK2-TRP/-TRC, with an Hitachi KP-D20B video camera ($100,000) for real time visualization. The Photonic, Electronic, and Fluidic FBBGs require an XPS system ($786,000) to provide the capability of identifying chemical species and determining their chemical state which is critical for analysis of oxides, semiconductors, and biomolecules. There is no working XPS system at WVU. **In YR 2**, an improved e-beam lithography system ($750,000) is required for high-resolution (resolution < 10 nm) capable of writing over large areas (≥ 10 μm) using interferometry to fabricate arrays of nanocontacts and other bio-electronic circuits. Current e-beam writing facility does not have the capability of accurately translating the sample over large distances. A Cl-based Reactive Ion Etching (RIE) System ($250,000) is required for use in electronic and photonic device fabrication focusing on wide band gap semiconductors, eg nitrides and arsenides and also other refractory materials like alumina. **In YR 3**, an XRD System ($250,000) is required by the Photonic FBBG and Fluidic FBBG. The XRD system is for multi layer semiconductor characterization and will be set up for reciprocal lattice mappings to facilitate surface engineering for biolayer attachment. For the Nanokinematic FBBG, an ABAI 394 Automated DNA Synthesizer ($65,000 total = $26.18K NSF; $32.5K WVURC; $6.32K RCF) is required to synthesize modified DNAs consisting of custom, base-modified oligonucleotides that have conformational properties that can be tailored to specific applications (these can not be made by outside vendors). This instrument will replace a current instrument that has reached the end of its useful life.

E. Travel: NSF support is requested ($10K/year; $30K for three years) to cover travels costs of participating faculty associated with completing FBBG research, travel to professional meetings, conferences, & presentations, and to build research collaborations. This is matched by WVURC ($4K/yr) and State RCF ($4K/yr). To supervise the EHRDO activities and coordinate the Alliance Partnership with MU and WVSU by WVNano Assoc. Director, NSF support of ($500/mon x 12 = $6K/yr; $18K for three years) is requested. WVURC and State RCF funds will support the following travel costs to assure effective administration of the project and to promote greater jurisdictional, regional, and national collaborations: (1) Co-PI WVU EPSCoR Coordinator travel for conferences/meetings/presentations & jurisdictional collaboration ($500/mon x 12 = $6K/year supported by WVURC); (2) Co-PI Technical, WVNano Director, Associate Director travel for conferences, meetings, & presentations, and jurisdictional collaboration (3 people x $500/mon each x 12 = $18K/yr supported equally by WVURC and State RCF. (3) Faculty jurisdictional travel for existing research collaborations @ $500/mon x 12 = $6K/yr supported equally by WVURC and State RCF. (4) Faculty Site Visits to NSF & other federal programs @ $600/participant trip. (YR 1: 15 trips = $9K; YR 2: 20 trips = $12K; YR 3: 25 trips = $15K supported by WVURC)

F. Participant Support Costs (66 participants/year)
Undergraduate Retention and Completion: NSF funds are requested to provide 20 stipends for six-week Summer Bridge Program for Entry level STEM (freshman/sophomore UREP – minorities [priority], women, individuals with disabilities, and economically disadvantage and/or first generation students.) Each $3,600 stipend will cover $1,200 tuition & fees, $1,600 subsistence, $200 books, and $600 enhancement activities. (20 stipends/year x $3,600/stipend = $72K/yr; $216K for three years) A summer peer mentor will be supported @ $1,200/ year as well as an academic

year peer mentor @ $3,400/year by State RCF funds. The support for two supplemental instructors @$3,400/year will be divided: YR 1: $5,695 NSF; $1,105 RCF; YR 2 - $1,660 NSF, $149 RCF, $4,991 WVURC; YR 3 - $6,800 WVURC. Research Experiences Program Stipends: Each $3,500 stipend will cover $1,200 tuition & fees, $1,600 subsistence, $100 books, and $600 enhancement activities. 20 stipends x $3,500/stipend = $70,000/year; YR 1 - $42,934 NSF and $27,066 RCF; YR 2 - $43,454 and $26,546 RCF; YR 3 - $39,818 and $30,182 RCF.
Summer Bridge Graduate Programs: For the BS to Graduate Education component, NSF support for stipends is requested for eight (8) UREP rising seniors or recent BS degree graduates to participate in summer bridge program to prepare them for entry into graduate programs. Bridge stipends @ $3,500 ($1200 Tuition & Fees, $1500 subsistence/6 weeks, $200 books & supplies, $600 Enhancement Activities) for each participant for six week program x 8 = $28K/year for YR 1 and YR 2 is requested. For YR 3, NSF support request is reduced to $25,464 with $2,536 provided by WVURC. For these eight students, GRE Prep Course Training ($3K/yr; $9K for three years) and a Peer Mentor ($1,200/yr; $3,600 for three years) will be supported through State RCF. State RCF funds will also support eight (8) research experience fellowships @ $2000 each ($16K/yr; $48K for three years) for additional participants. For MS to Ph.D. Education, State RCF funds will support four (4) UREP stipends for Bridge Program @ $5K/6 weeks = $20K/yr and a peer mentor stipend @ $1,200/yr.

G. Other Direct Costs:
G1. Materials and Supplies: NSF support is requested for start-up materials and supplies ($20,000) for each new hires for first year of hire only. YR 1 - $20,000/hire x 7 hires + director = $160K; YR 2 - $20,000/hire x 3 hires = $60K for a cost of $220K for three years. NSF funds are also requested for materials and supplies to support FBBGs work (YR 1 - $10,422; YR 2 - $35,000; YR 3 - $152,620 for total cost of $198,062 for three years). State RCF will provide materials and supplies support to FBBGs work in the amounts of YR 1 - $2,000 and YR 2 - $45K.
***G2. Publication Costs/Documentation/Dissemination*:** For New Hire and FBBG work, NSF support is requested: Yr 1 - $14,000; YR 2 - $18,859, YR 3 - $22,000 for total cost of $54,859 for three years.
G3. Consultant Services: NSF funds are requested for a Distinguished Speaker Series to host internationally/nationally recognized scientists in bio/nanosciences, engineering, and education, 2 to 3 times/yr, $10K/yr x 3 yr = $30K. For services related to EHRDO component, Grant Writer's Seminar titled "*Getting Started as a Successful Grant Writer and Academician"* with targeted Grant Application Workshop titled *" Write and Submit a Completed Grant Application"* consultant fee, $3,200/participant x 8 participants/yr = $25,600 for YR 1 support by State RCF ($23,895) and WVURC ($1,705); Services adjusted 4% in Yr 2 and 3 for inflation; three year total cost = State RCF $74,591 and WVURC $5,322. WVURC funds will support Faculty Mentor released time for senior/experienced grant-writing faculty (L. Hornak, T. Myers, P. Famouri, P. Gannett, D. Lederman, A. Timperman) to mentor junior faculty and postdoctoral fellows (2-3 mentees/faculty; one course (3 credit) released time/semester x 2 semesters/AY @ $10,710 replacement cost/faculty mentor/year x 6 mentors/yr = $64,260 + 27.5% fb = $81,932 total for YR 1. Services adjusted 4% in Yr 2 and 3 for inflation; three year total cost = $256,577. State RCF will support mentor training of peer mentors from WVU, MU and WVSU (3-day workshop) to prepare senior-level STEM undergraduate students to serve as peer mentors for the Summer Bridge Program and the Undergraduate Retention and Completion Activities, $24,000/yr x 3 yr = $72,00 total.
G6. Other:
Maintenance Contracts on Equipment/Instruments: WVURC and State RCF resources will support maintenance contracts for existing major shared equipment and new equipment as initial warranties expire. (Yr 1: $54K RCF, $6K WVURC; YR 2: $59K RCF; $34K WVURC; Yr 3: $59K RCF, $59 K WVURC) Support will transition to a mix of institutional and user support as a fee schedule is implemented under shared facility management.
Start-up Packages: WVURC will support new hire start-up packages @ $400K average per New Hire. Start-up Package will be disbursed over two years. WVURC will provide a total of $3.6M (YR 1 - $1.4M; YR 2 - $1.6M; and YR 3 - $600K) in start-up funds.
Technical Administration and EHRDO Coordination Expense: WVURC and State RCF will support expenses ($60K/yr; $180K for three years) associated with maintenance of an administrative office (space, telephone, fax, office equipment and supplies, etc.) for project's technical and EHRDO coordination. RCF will support YR 1 with equal support by WVURC and State RCF in YR 2 and YR 3.
Nano-Biosciences Interactive Series: WVURC will support ($10K/yr) for periodic seminars to engage participating faculty, postdoctoral fellows, graduate & undergraduate students, and external speakers/visitors in collaborative discussions on progress toward project milestones and current topics.

Paul Hill, Ph. D.

Project Title: "West Virginia Blueprint for Science and Technology: Strengthening Statewide Multidisciplinary Academic Research Infrastructure" (EPS-0314742) and (EPS-0132740)
Source of Support: NSF
Total Award Amount: $$8,946,994.00 + $600, 000 supplement
Start Date: 01/01/03
End Date: 03/31/05
Support: current
Person-Months Per Year Committed to the Project: 8
NOTE: This award was transferred to the Higher Education Policy Commission on 1/1/03. Supplement was received 04/05

Project Title: "Rural Systemic Initiatives in Science, Mathematics, and Technology Education - RSI: Coalfield Rural Systemic Initiative: Building Bridges to the Future" (Proposal number: 0135822)
Source of Support: NSF
Total Award Amount: $4,500, 000.00
Start Date: 03/01/02
End Date: 02/28/07
Support: current
Person-Months Per Year Committed to the Project: 1

Project Title: Research Strategies in Science Engineering and Technology (ReSSET): A WV Planning Proposal. (NSF-0527409)
Source of Support: NSF
Total Amount of Award: $199,978.00
Start Date: 4/1/05
End Date: 11/30/05
Support: Current
Person-Months Per Year Committed to Project: 1

Project Title: "Research Challenge Fund of West Virginia- Research and STEM Education Investments" (EPS-0132740)
Source of Support: State of West Virginia
Total Award Amount: $4,800,000.00 (annual)
Start Date: 07/01/04
End Date: 06/30/06
Support: Current
Person-Months Per Year Committed to the Project: 2

Howard Aulick, Ph.D.

Project Title: NSF R-2 Planning Grant
Source of Support: Higher Education Policy Commission
Total Award Amount: $10,000
Start Date: 6/1/05
End Date: 11/30/05
Support: Current

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Lawrence A. Hornak

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

ITR Collaborative Researh: Biometrics - Performance, Security, and Society

Source of Support: NSF Medium ITR

Total Award Amount: $3,080,000 Total Award Period Covered: 2/15/04 - 2/14/08

Location of Project: WVU, MSU, Clarkson, St.Lawrence, U of Pittsburgh

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 0.5

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Nanofilament Directional Control within a Hybrid Microelectronic Actin-Myosin Motility Assay via Integrated Addressing

Source of Support: NSF NER

Total Award Amount: $90,000 Total Award Period Covered: 8/1/04 - 7/31/05

Location of Project: WVU

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 0.5

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Phase I Research Support for Multimodal Biometrics

Source of Support: Lockheed-Martin / DoD

Total Award Amount: $ 715K Total Award Period Covered: 12/1/04 - 11/30/05

Location of Project: WVU, MSU, Clarkson, St.Lawrence

Person-Months Per Year Committed to the Project. .7 Cal: Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

DoD BFC Research and Education Support

Source of Support: Comp. Sci. Corp./ DoD

Total Award Amount: $ 510K Total Award Period Covered: 1/1-12/31/05

Location of Project: WVU

Person-Months Per Year Committed to the Project. 1 Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

NBSP Biometrics Standards, Research, and Education

Source of Support:

Total Award Amount: $ 450K Total Award Period Covered: 1/1/05 - 9/30/05

Location of Project: WVU, NBSP

Person-Months Per Year Committed to the Project. .5 Cal: Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Lawrence A. Hornak	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

MEMS-based Integrated Photonic Technology for in-situ Microstructure Monitoring

Source of Support: NASA

Total Award Amount: $540,471 Total Award Period Covered: 08/01/01 - 07/31/05

Location of Project: WVU

Person-Months Per Year Committed to the Project. Cal: 1 Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Nd:YAG Laser Resonator Chip Design, Validation, and Optical Characterization

Source of Support: DOE NETL

Total Award Amount: $100,000 Total Award Period Covered: 09/10/02 - 2/28/05

Location of Project: WVU, NETL

Person-Months Per Year Committed to the Project. Cal: 0.5 Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Towards Fieldable Rapid Bioagent Detection: Advanced Resonant Optical Waveguide and Biolayer Structures for Integrated Biosensing

Source of Support: ONR

Total Award Amount: $500,000 Total Award Period Covered: 05/01/03 - 04/30/06

Location of Project: WVU

Person-Months Per Year Committed to the Project. Cal: 0.75 Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

WV Blueprint for S&T: Strengthening Statewide Multidisciplinary Academic Research Infrastructure

Source of Support: NSF

Total Award Amount: $9,000,000 Total Award Period Covered: 04/01/02 - 3/31/05

Location of Project: WVU, Marshall

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 1.0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Operating Grant: Center for Identification Technology Research (CITeR)

Source of Support: NSF I/UCRC and Member Orgs

Total Award Amount: $1.33M Total Award Period Covered: 12/15/01 - 11/30/06

Location of Project: WVU, MSU, U of Pitt, Clarkson, St. Lawrence

Person-Months Per Year Committed to the Project. Cal: 1.0 Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Curt M. Peterson, Ph.D.

Project Title: "Seedhead Shattering in a Native Grass: A Preliminary Histological Study:
Source of Support: USDA NRICGP
Total Award Amount: $73,169
Start Date: 12/01/02
End Date: 09/31/05
Support: Current
Person-Months Per Year Committed to the Project: 0.0

Project Title: "Factors Influencing the Health of Roadside Vegetation"
Source of Support: Colorado Department of Transportation/U.S. Department of Transportation Federal Highway Administration
Total Award Amount: $138,628
Start Date: 12/01/02
End Date: 09/31/05
Support: Current
Person-Months Per Year Committed to the Project: 0.0

Project Title: "Northern Colorado High Plains Mathematics and Sciences Partnership for Teachers and Students"
Source of Support: Colorado Department of Education
Total Award Amount: $679,185
Start Date: 03/01/04
End Date: 02/28/07
Support: Current
Person-Months Per Year Committed to the Project: 0.0

Jan R. Taylor, Ph. D.

Project Title: "West Virginia Blueprint for Science and Technology: Strengthening Statewide Multidisciplinary Academic Research Infrastructure" (EPS-0314742) and (EPS-0132740)
Source of Support: NSF
Total Award Amount: $$8,946,994.00 + $600, 000 supplement
Start Date: 01/01/03
End Date: 03/31/05
Support: current
Person-Months Per Year Committed to the Project: 6
NOTE: This award was transferred to the Higher Education Policy Commission on 1/1/03. Supplement was received 04/05

Project Title: Research Strategies in Science Engineering and Technology (ReSSET): A WV Planning Proposal. (NSF-0527409)
Source of Support: NSF
Total Amount of Award: $199,978.00
Start Date: 4/1/05
End Date: 11/30/05
Support: Current
Person-Months Per Year Committed to Project: 4

Project Title: "Research Challenge Fund of West Virginia- Research and STEM Education Investments" (EPS-0132740)
Source of Support: State of West Virginia
Total Award Amount: $4,800,000.00 (annual)
Start Date: 07/01/04
End Date: 06/30/06
Support: Current
Person-Months Per Year Committed to the Project: 2

Current and Pending Support

Phyllis J. Barnhart

Project/Proposal Title: **Retool and Enhance**
Support: **Current**
Source of Support: **NASA**
Total Award Amount: **$496,446** Total Award Period Covered: **06/01/05 - 05/31/07**
Location of Project: **AEL, Inc.**
Person-Months Per Year Committed to the Project. Cal: **1.00** Acad: **0.00** Sumr: **0.00**

Project/Proposal Title: **Coalfield Rural Systemic Initiative: Building Bridges to the Future (NSF ERS 0135822)**
Support: **Current**
Source of Support: **NSF**
Total Award Amount: $**4,500,000** Total Award Period Covered: **03/01/02 - 02/28/07**
Location of Project: **AEL, Inc.**
Person-Months Per Year Committed to the Project. Cal: **1.00** Acad: **0.00** Sumr: **0.00**

Eric Blough, Ph.D.

Project Title: Response of vascular smooth cells to stretch
P.I. Robert T. Harris
Source of Support: National Institutes of Health, R-01
Total Award Amount: $1,500,000
Start Date: 9/03
End Date: 9/08
Support: Current
Person-Months Per Year Committed to the Project: Academic: 10%

Project Title: Mechanosensory signal transduction in aging muscle
Source of Support: National Institutes of Health, R-01
Total Award Amount: $75,000
Start Date: 9/02
End Date: 9/03
Support: Current
Person-Months Per Year Committed to the Project: Academic: 15%

Project Title: Mechanotransduciton in the meniscus
P.I. Tammy Donahue
Source of Support: Whitaker Foundation
Total Award Amount: $210,000
Start Date: 9/02
End Date: 9/05
Support: Current
Person-Months Per Year Committed to the Project: Academic: 10%

Project Title: Skeletal muscle mechanotransduction
Source of Support: National Institutes of Health, R-01
Total Award Amount: $675,000
Start Date: 10/05
End Date: 10/08
Support: Pending
Person-Months Per Year Committed to the Project: Academic: 20%

Project Title: Sarcopenia, signal transduction and exercise intervention
Source of Support: National Institutes of Health, R-21
Total Award Amount: $385,000
Start Date: 11/05
End Date: 11/06
Support: Pending
Person-Months Per Year Committed to the Project: Academic: 15%

Project Title: Aging, aortic stiffness and signaling
Source of Support: National Institutes of Health, R-15

Total Award Amount: $225,000
Start Date: 10/05
End Date: 10/07
Support: Pending
Person-Months Per Year Committed to the Project: Academic: 15%

Current and Pending Support

Boyd Edwards, Ph.D.

Support: **Pending**
Source of Support: **NIH STTR**
Total Award Amount: **$297,023** Total Award Period Covered: **1/1/06 - 6/30/07**
Location of Project: **West Virginia University**
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: **1.5**

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Parviz Famouri

Other agencies (including NSF) to which this proposal has been/will be

Support: ☐X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Nanofilament Directional Control within a Hybrid Microelectronic Actin-Myosin Motility Assay

Source of Support: NSF

Total Award Amount: $90,000 Total Award Period Covered: 8/1/2004-7/31/2005

Location of Project: West Virginia University

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:0.5

Support: **X** Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

MicroelectroMechanical Systems (MEMS)-based Integrated Photonic Technology for *in-situ* Microstructure Monitoring and Control: Enabling Technology for MEMS Quality Assurance

Source of Support: NASA

Total Award Amount: $540,471 Total Award Period Covered: 11/1/01 □ 10/31/04

Location of Project: WVU

Person-Months Per Year Committed to the Project. Cal: Acad: 1 Sumr: 0.5

Support: Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: **X** Current ☐Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Cold-Flow Fluidized-bed Identification Control

Source of Support: DOE

Total Award Amount: $450,000 Total Award Period Covered: 6/15/01 - 6/14/05

Location of Project: WVU

Person-Months Per Year Committed to the Project. Cal: Acad: 1.0 Sumr: 0.5

Support: ☐Current Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator:

Other agencies (including NSF) to which this proposal has been/will be

Support: Current Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: 0.0 Sumr: 0.0

Support: Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Source of Support:
Total Award Amount: Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: 0.0 Sumr: 0.0

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

Daniel C. Flynn, PhD

Support – Active

3R01-CA60731-11 Daniel C. Flynn (PI) 4/1/94 to 3/31/09
25%
NIH/NCI $192,000/yr
AFAP-110 effects actin filament integrity
Goal: To determine the mechanism by which AFAP-110 alters actin filament integrity.

P20 RR16440-03 Daniel C. Flynn (PI) 9/30/01 to 9/29/06
32%
NIH/NCRR $1,500,000/yr
Cobre in Signal Transduction
Goal: To establish a Center of Biomedical Research Excellence (COBRE) in Signal Transduction and Cancer. Supports five junior faculty members and their research programs, 5 new faculty recruits and creation of 2 core facilities. The PI acts as a director and receives salary support, only.

R01-CA60731-MS1 Daniel C. Flynn (PI) 5/1/04 to 4/30/08
[1%]
NIH/NCI $25,000/yr
Supplement to "AFAP-110 effects actin filament integrity"
Goal: A minority supplement to support Valerie Walker as a grad student.

1T32ES10953-02 John B. Barnett (PI) 7/01/01 to 6/30/06
[5%]
NIH/NIEHS $759,228/yr
Training Program in Immunotoxicology
Goal: To provide support for 4 graduate students and 2 post doctoral fellows. DCF mentors 1 graduate student.
Role: Mentor

R01-ES11311-01A1 John B. Barnett (PI) 9/1/2002 to 6/30/06
5%
NIH/NIEHS $225,000/yr
Effects of the Herbicide, Propanil, on T cell signaling
Goal: To identify the mechanism by which propanil alters signaling in T cells.
Role: collaborator

NIH – P20-RR016477-04 Jim Sheil (PI) 6/1/04 – 5/31/09
5%
NCRR $489,908/yr
Title: West Virginia Idea Networks of Biomedical Research Excellence (WV-INBRE)
Goal: To create a network for training undergraduate scientists and faculty at small colleges to do medical research by mentoring undergraduate students and faculty from small colleges to do summer research projects. DCF mentors a faculty member from Wheeling Jesuit University.
Role: Mentor

NSF – no assignment # D.C. Flynn (PI) 1/1/05 – 12/31/08
5%
NSF/WVEPSCoR $350,000/yr
Title: Cancer Nanotechnology Training Program
Goal: to foster collaborative graduate student training in West Virginia State Universities in the area of Cancer biology and nanotechnology.

NIH – CA109748-01A1 C. Gladson (PI) 7/1/04 – 6/30/09
5%
NIH/NCI $25,000/yr
Title: The Role of Lyn in Glioma Progression and Migration
Goal: This is a subcontract with the U. Alabama @ Birmingham to generate Lyn/Fyn chimeras and analyze their affects on cellular signals that alter actin filament integrity and promote motility in glioblastoma.
Role: Subcontract.

Other Support – Pending

GM077383-01 D.C. Flynn (PI) 7/1/05 – 6/30/10
20%
NIH/NCI $200,000/yr
Title: Integrating signals between PKCα, cSrc and PI3K

Goal: to determine the mechanism by cellular signals are integrated to initiate podosome formation
Review Date: October 2005 (ZRG1-1C1)

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Peter M. Gannett

Other agencies (including NSF) to which this proposal has been/will be

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Mechanisms of Atypical Drug Kinetics and Interactions

Source of Support: National Institutes of Health

Total Award Amount: $1,250,000 Total Award Period Covered: 04/01/04-03/31/04

Location of Project: WV University and University of Minnesota - Minneapolis

Person-Months Per Year Committed to the Project. 1.2 Cal: X Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Training Grant in Cancer Nanotechnology

Source of Support: WV EPSCoR

Total Award Amount: $1,400,,000 Total Award Period Covered: 3/1/02-2/28/05

Location of Project: WV University

Person-Months Per Year Committed to the Project. 1.2 Cal: X Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Dapsone Activation of CYP2C9: A Molecular Modeling Study

Source of Support: NIH

Total Award Amount: $770,000 Total Award Period Covered: 06/01/04-05/31/09

Location of Project: WV University and West Liberty State College

Person-Months Per Year Committed to the Project. 0.6 Cal: X Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Substrate Interactions with Drug Metabolizing Enzymes

Source of Support: NIH

Total Award Amount: $ 190,000 Total Award Period Covered: 04/01/04-03/31/06

Location of Project: University of Minnesota

Person-Months Per Year Committed to the Project. 0.6 Cal: X Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Mechanisms of Atypical Drug Kinetics and Interactions

Source of Support: NIH

Total Award Amount: $1,250,000 Total Award Period Covered: 7/01/04-6/30/09

Location of Project: West Virginia University and University of Minn-Minneapolis

Person-Months Per Year Committed to the Project. 1 Cal: X Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Peter M. Gannett

Other agencies (including NSF) to which this proposal has been/will be

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Nanofilament Directional Control within a Hybrid Microelectronic Actin-Myosin Motility Assay via Integrated Electric Field Addressing

Source of Support: NSF

Total Award Amount: $90,000 Total Award Period Covered: 04/01/04-03/31/05

Location of Project: WV University

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal TitleModeling enzyme-ligand interactions in a cytochrome P450 system

Source of Support: NSF

Total Award Amount: $990,612 Total Award Period Covered: 7/1/2005-6/20/2008

Location of Project: West Virginia University

Person-Months Per Year Committed to the Project. 0.6 Cal: x Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Acquisition of a X-ray Photoelectron Spectrometer

Source of Support: NSF

Total Award Amount: $ 298,680 Total Award Period Covered 7/1/2005-6/30/2005

Location of Project: West Virginia University

Person-Months Per Year Committed to the Project. Cal: x Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support: NSF

Total Award Amount: Total Award Period Covered:

Location of Project: West Virginia University

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Philippe Georgel, Ph.D.

Project Title: New models for the role of chromatin in controlling inducible gene transcription
P.I. F. Shannon
Source of Support: Australian Research Corporation
Total Award Amount:
Start Date: 1/01/05
End Date: 1/31/07
Support: Current
Person-Months Per Year Committed to the Project: Academic: 5%

Project Title: CHD-1, -2: potential markers of Sjogren syndrome
Source of Support: National Institutes of Health, R-21
Total Award Amount: $250,000
Start Date: 9/1/06
End Date: 8/31/08
Support: Pending
Person-Months Per Year Committed to the Project: Academic: 15%

Project Title: Regeneration of salivary glands function during cancer treatment
Source of Support: National Institutes of Health, R-03
Total Award Amount: $250,000
Start Date: 1/1/06
End Date: 12/31/07
Support: Pending
Person-Months Per Year Committed to the Project: Academic: 10%

Current and Pending Support-Marcia A. Harrison

Current Support:

Project Title:	CREES: NRI-Kinetic Analysis of Plant Ethylene Production Using Photoacoustic Spectroscopy
Source:	**USDA**
Project Location:	Marshall University.
Total Award Amount:	$ 10,500.00
Project period:	9/1/2005-8/31/2006
Person-months per year:	0 months

Pending Support:

Project Title:	Advancing Women in Science, Math and Engineering
Source:	**National Science Foundation**
Project Location:	Marshall University.
Total Award Amount:	$3,749,759
Project period:	July 2006 - June, 20011
Person-months per year:	3 person-months, 1.5 summer months

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: **Dimitris Korakakis**

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Investigation of Bandgap Engineering Techniques to Obtain Long Wavelength Emission from InGaNAs Fabry-Perot Heterojunctions**

Source of Support: **NSF**

Total Award Amount: $ **307,532** Total Award Period Covered: **06/01/01 - 05/31/05**

Location of Project: **WVU**

Person-Months Per Year Committed to the Project. Cal:**0.00** Acad: **0.00** Sumr: **1.00**

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Alternative Approaches To P-Type Doping In GaN And Related Alloys**

Source of Support: **US Army Research Office**

Total Award Amount: $ **560,000** Total Award Period Covered: **06/01/01 - 05/31/05**

Location of Project: **WVU**

Person-Months Per Year Committed to the Project. Cal:**0.00** Acad: **0.00** Sumr: **0.00**

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Towards Fieldable Rapid Bioagent Detection: Advanced Resonant Optical Waveguide and Biolayer Structures for Integrated Biosensing**

Source of Support: **ONR**

Total Award Amount: $ **500,000** Total Award Period Covered: **01/06/03 - 05/31/06**

Location of Project: **WVU**

Person-Months Per Year Committed to the Project. Cal:**0.00** Acad: **0.00** Sumr: **0.75**

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Summ:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: **Dimitris Korakakis**

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: **Project-Based Integration of Undergraduate Education and Competitive Technical Research**

Source of Support: **NSF**
Total Award Amount: $ **101,355** Total Award Period Covered: **01/01/06 - 12/31/06**
Location of Project: **WVU**
Person-Months Per Year Committed to the Project. Cal: **0.00** Acad: **0.00** Sumr: **1.00**

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Summ:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

A. Joseph Kusimo, P.E.

Project Title: "The development of collaborative relationship between West Virginia State University and NASA IV&V" (NNG04GNN99G)
Source of Support: NASA
Total Award Amount: $100,000, + $130,000 supplement
Start Date: 07/15/04
End Date: 09/30/06
Support: current
Person-Months Per Year Committed to the Project: 12
NOTE: Started position with WVSU May 2005, and inherited the project.

Project Title: "Establishment of NASA Educator Resource Center at West Virginia State University" (Proposal number: 0990263)
Source of Support: NASA
Total Award Amount: $65,000.00
Start Date: 01/01/06
End Date: 12/31/06
Support: current
Person-Months Per Year Committed to the Project: 2

Current and Pending Support
David Lederman

1. Project/Proposal Title: **Acquisition of a X-ray Photoelectron Spectrometer** (Lederman PI, Myers, Timperman, Manivannan, Gannett Co-PI's)
   Source of Support: **NSF/MRI**
   Support: **Pending**
   Total Award Amount: **$298,680**Total Award Period Covered: **07/01/2005 06/30/2006**

2. Project/Proposal Title: **Inter-American Materials Collaboration (CIAM): West Virginia University - Pontificia Universidad Catolica de Chile Collaboration on Multifunctional Materials** (Lederman PI, Myers)
   Source of Support: **NSF**
   Support: **Current**
   Total Award Amount: **$156,000** Total Award Period Covered: **06/01/2005 – 05/31/2007**

3. Project/Proposal Title: **Exchange Bias of Ideal Antiferromagnetic Films** (Lederman PI – sole investigator)
   Source of Support: **NSF/DMR**
   Total Award Amount: $**330,000** Total Award Period Covered: **04/01/2004 – 03/31/2007**
   Location of Project: **West Virginia University**

4. Project/Proposal Title: **MURI Laboratory Instrumentation Design Research for Scaleable Next Generation Epitaxy: NEW EPIC (**Myers, Doolittle (GTRI, PI), Lederman, Moustakas (BU), Schaff (Cornell), Frazier (GIT), Selloni (Princeton)**)**
   Source of Support: **DoD/MURI**
   Total Award Amount: $**603,934** Total Award Period Covered: **05/15/03 - 05/14/08**
   Location of Project: **Georgia Institute of Technology, Boston University, Cornell University, Princeton University, West Virginia University**

5. Project/Proposal Title: **An Investigation of Electron Irradiation on the Growth of Group III-Nitride Semiconductors and the Growth of Epitaxial Ferroelectric Layers on GaN (**T. H. Myers PI, Lederman**)**
   Source of Support: **ONR**
   Total Award Amount: $**330,000** Total Award Period Covered: **10/01/02 - 09/30/05**
   Location of Project: **West Virginia University**

Biographical Sketch: Jaroslava Miksovska

a. Professional Preparation

Charles University at Prague	B.S. (Biochemistry)	1992
Charles University at Prague	M.S. (Biochemistry)	1994
University of Paris	Ph.D. (Biochemistry)	1998
University of Hawaii	Post-doctoral Fellow	2000-2001
University of South Florida	Post-doctoral Fellow	2002-2004

b. Appointments

Marshall University, Huntington, WV, Assistant Professor, 2004 to present

c. Publications

Publications Relevant to the Proposed Project:

Miksovska, J., Suquet, C., Satterlee, J.D., Larsen, R.W. Characterization of Conformational Changes Coupled to Ligand Photodissociation from the Heme Binding Domain of FixL. (2005) *Biochemistry*, accepted.

Miksovska, J., Gennis, R.B., and Larsen, R.W. Photothermal studies of CO photodissociation from mixed valence Escherichia coli cytochrome bo_3. *FEBS Lett*, (2005) in print.

Miksovska, J., Norstrom, J., and Larsen, R.W. Thermodynamic Profiles for CO Photodissociation from Heme Model Compounds: Effect of Proximal Ligands. *Inorganic Chemistry*, (2005) 44 (4), 1006-1014.

Miksovska, J., and Larsen, R.W. Structure-Function Relationships in Metalloproteins. *Methods in Enzymology*: Biophotonics, Marriott, G. and Parker, I., Ed. 2003, 360, part A, 302-329.

Miksovska, J., Day, J.H., Larsen, R.W. Volume and Enthalpy Changes Coupled to CO Rebinding to Horse Heart Myoglobin. *Journal of Biological Inorganic Chemistry,* 2003, 8 (6): 621-625.

Other Significant Publications-Co-Authored by Undergraduate Students:

Miksovska, J., and Larsen, R.W. Time resolved photoacoustic study of Ruthenium(II) bis (2,2'-bipyridine)(4,4'-dicarboxy-2,2'bipyridine) complex. *Inorganic Chemistry*, (2004) 43 (14), 4051-4055.

Miksovska J, and Larsen RW. Photothermal Studies of pH Induced Unfolding of Apomyoglobin. *Journal of Protein Science*, 2003, 22 (4): 387-394.

Tandori J, Miksovska J, Valerio-Lepiniec M, Schiffer M, Maroti P, Hanson DK, Sebban P. Proton uptake of Rhodobacter capsulatus reaction center mutants modified in the primary quinone environment. *Photochem Photobiol.* 2002, 75(2): 126-33.

Miksovska J, Schiffer M, Hanson DK, Sebban P. Proton uptake by bacterial reaction centers: the protein complex responds in a similar manner to the reduction of either quinone acceptor. *Proc Natl Acad Sci U S A.* 1999, 96(25):14348-53.

Miksovska J, Valerio-Lepiniec M, Schiffer M, Hanson DK, Sebban P. Mutations in the environment of the primary quinone facilitate proton delivery to the secondary quinone in bacterial photosynthetic reaction centers. *Biochemistry,* 1999, 38(1):390-8.

d. Synergistic Activity

* Development of teaching material for intermediate biochemistry course with focus on information and signal transfer.

* the interdisciplinary nature of the research in the lab involves wide range of concepts and techniques providing an opportunity for students to learn biochemistry techniques (protein purification and isolation techniques), master biophysical techniques such as time resolved spectroscopy and photothermal techniques and become familiar with data analyses software. This broad and purely interdisciplinary experience provides important contribution to students professional development.

* supervising summer research project of 4 undergraduate students, among them 2 women (one of them Hispanic).

e. Collaborations & Other Affiliation

Collaborators:

Dr. James D. Satterlee, Washington State University, Pullman, WA,

Dr. Wenji Dong, University of Alabama, Birmingham
Dr. Robert B. Gennis, University of Illinois at Urbana-Champaign, Illinois

Graduate and Postdoctoral Advisors:

Pierre Sebban, University of Paris XI, Orsay, France, Ph.D., Graduate Advisor
Randy W. Larsen, University of South Florida, Tampa, FL, Postdoctoral Advisor

Thesis Advisor and Postgraduate-Scholar Sponsor: none

Current and Pending Support

Thomas H. Myers

Project/Proposal Title: **EPITAXIAL MATERIALS *WITHOUT* EPITAXIAL CONSTRAINTS**
Support: **Pending**
Source of Support: Subcontract to **Penn State/ MURI/ARO**
Total Award Amount: $**1,045,894** Total Award Period Covered: **04/01/05 - 03/31/10**
Location of Project: **West Virginia University**
Person-Months Per Year Committed to the Project. Cal: **1.00** Acad: **0.00** Sumr: **0.00**

Project/Proposal Title: **Inter-American Materials Collaboration (CIAM): West Virginia University - Pontificia Universidad Catolica de Chile Collaboration on Multifunctional Materials (with D. Lederman-PI)**
Source of Support: **NSF**
Support: **Current**
Total Award Amount: **$227,050** Total Award Period Covered: **05/01/2005 – 04/30/2007**
Location of Project: **West Virginia University**
Person-Months Per Year Committed to the Project. Cal: **0.50** Acad: **0.00** Sumr: **0.00**

Project/Proposal Title: **MURI Laboratory Instrumentation Design Research for Scaleable Next Generation Epitaxy: NEW EPIC (with co-PI D. Lederman)**
Support: **Current**
Source of Support: **Georgia Institute of Technology/AFOSR**
Total Award Amount: $**603,934** Total Award Period Covered: **05/15/03 - 04/30/08**
Location of Project: **West Virginia University**
Person-Months Per Year Committed to the Project. Cal: **1.00** Acad: **0.00** Sumr: **0.00**

Project/Proposal Title: **An Investigation of Electron Irradiation on the Growth of Group III-Nitride Semiconductors and the Growth of Epitaxial Ferroelectric Layers on GaN (with co-PI D. Lederman)**
Support: **Current**
Source of Support: **ONR**
Total Award Amount: $**330,000** Total Award Period Covered: **10/01/02 - 09/30/05**
Location of Project: **West Virginia University**
Person-Months Per Year Committed to the Project. Cal: **1.00** Acad: **0.00** Sumr: **0.00**
No relation to proposed MURI

Project/Proposal Title: **Investigation of Band Gap Engineering Techniques to Obtain Long Wavelength Emission from InGaNAs Fabry-Perot Heterojunctions (with PI Dimitris Korakakis)**
Support: **Current**
Source of Support: **NSF**
Total Award Amount: **$307,531 Total Award Period Covered: 6/01/01 to 5/31/05**
Location of Project: **West Virginia University**
Person-Months Per Year Committed to the Project. Cal: **0.00** Acad: **0.0** Sumr: **1.00**

Project/Proposal Title: **Alternative Approaches to P-Type Doping in GaN and Related Alloys (with D. Korakakis and C.D. Stinespring)**
Support: **Current**
Source of Support: **ONR**
Total Award Amount: **$365,000 (+$195,438 in cost share)**
Total Award Period Covered: **4/1/01 to 3/31/05**
Location of Project: **West Virginia University**
Person-Months Per Year Committed to the Project. Cal: **0.00** Acad: **1.00** Sumr: **1.00**

Project/Proposal Title **Fundamental Material Studies of p-type Arsenic-doped HgCdTe (with N. Giles)**
Support: **Current**
Source of Support: ElectroOptic Center/Air Force Materials Lab
Total Award Amount: **$225,000** Total Award Period Covered: **4/02-8/05**
Location of Project: **West Virginia University**
Person-Months Per Year Committed to the Project. Cal: **1.00** Acad: **0.00** Sumr: **0.00**

Project/Proposal Title: **WV NSF EPSCOR (With numerous WVU and Marshal U. co-PIs)**
Support: **Current**
Source of Support: NSF
Total Award Amount (for T. Myers): **$50,000/yr for student support and supplies, plus infrastructure development($50k) and equipment funding (~ $500k)**
Total Award Period Covered: **Jan 2001 – Mar. 2005**
Location of Project: **West Virginia University**
Person-Months Per Year Committed to the Project. Cal: **0.00** Acad: **0.00** Sumr: **0.00**

Michael Norton, Ph.D.

Project Title: Directed Sequential Assembly via DNA Based Nanostructures
Source of support: U.S. Army Research Office
Location: Marshall University
Total Award Amount: $508,133
Start Date: 6/1/05
End Date: 5/31/08
Support: Current
Person-Months Per Year Committed to the Project: Academic: 0.70; Summer: 0.50 (10%)

Project Title: Transcription Factors in Cancer, Imaging Core
PI: Dr. Richard Niles
Source of support: NIH COBRE
Location: Marshall University
Total Award Amount: ~$600,000 (Imaging Core)
Start Date: 8/1/04
End Date: 6/31/09
Support: Current
Person-Months Per Year Committed to the Project: Academic: 0.0; Summer: 2.0 (20%)

Proposal Title: DNA Sensor Infrastructure Development:
Development of DNA Testing Expertise and Corporate Facility in Huntington
Source of Support: West Virginia State Research Challenge Fund
Location: Marshall University
Total Award Amount: $320,000
Start Date: 7/1/05
End Date: 6/30/06
Support: Pending
Person-Months Per Year Committed to the Project: Academic: 2.00 (20%)

Proposal Title: Acquisition of a Characterization System for Directed Sequential Self-Assembly of Nanostructures Research
Source of Support: Department of Defense: Defense University Research Instrumentation Program
Location: Marshall University
Total Award Amount: $193,050
Start Date: 8/1/06
End Date: 3/31/07
Support: Pending

Current and Pending Support

Aaron T. Timperman

CoBRE for Signal Transduction and Cancer
Source: NIH-NCRR, 5 P20 RR16440-03
PI: Dan Flynn
Total WVU award: $10,900,000 for 9/1/01 to 9/6/06
Co-PI: Timperman
The objective of this proposal is to prepare a microfluidic system for determination of cancer markers with the emphasis on the upstream separations and flow control within the microfluidic device.

Proteomics and Cancer: A Partnership between WVU and the Biotechnology Industry
Source: West Virginia Higher Education Policy Commission, RCG0306
PI: Timperman
Total award: $1,500,000 for 7/1/02-6/30/06.
The primary goal of this project is to develop and commercialize microfluidic tools for proteome analysis.

Towards Fieldable Rapid Bioagent Detection: Advanced Resonant Optical Waveguide and Biolayer Structures for Integrated Biosensing
Source: DoD/Office of Naval Research, N00014-03-0-0815
PI: Larry Hornak, Professor, Lane Depart. of C.S. & E.E., WVU
Total award: $500,000 for 5/1/03 – 4/30/06
Co-PI: Timperman
Timperman sub-award: $255,000
A microfluidic system is being developed for the detection of toxic proteins and biomarkers.

Electric Fields Effect on In-vitro Actin in Motility Assay
Source: NSF, ECS-0403742
Timperman - 0.5 calendar months
PI: Parviz Famori, Associate Professor, Lane Department of C.S. & E.E., WVU
Total award: $90,000 for 8/1/04-7/31/05
Co-PI: Timperman
Timperman sub-award: $26,000
The objective of this project is to control molecular motors to transport molecular cargos to addressable locations on a two-dimensional substrate, such as a protein or DNA array.

Seawater Proteomics
Source: NSF – Chemical Oceanography, proposal number: 0453737
PI: Timperman
Total award: $499,655 for 9/01/05-8/31/07
To understand the relationship between structure and stability of dissolved proteins in seawater to better understand carbon cycling and improve global health.

Core NSE Facility Base

The core NSE Triad facility base established by WVU and MU are summarized below. Those equipment items purchased through the support of the prior RII are underlined.

WVU

Materials and Device Growth, Fabrication, and Characterization

Semiconductor Materials Growth and Characterization Laboratories

Multifunctional Materials Laboratory

The MML is a result of the vision Lederman and Myers of fostering multidisciplinary collaboration at WVU. Working through the WVNano Initiative, these facilities which are located in Hodges Hall have been made available to collaborations with the Departments of Chemistry and Physics, the School of Pharmacy, and the College of Engineering and Mineral Resources (CEMR). The MML represents an infrastructure investment of over $3.5 Million, with funding coming from the Office of Naval Research, the National Science Foundation's Instrumentation for Materials Research, Materials Research Instrumentation, and EPSCoR programs, the West Virginia University Research Corporation, the Eberly College of Arts and Sciences, the West Virginia Challenge Grant program, and the Department of Physics. We have obtained equipment donations from General Electric, BAE, Texas Instruments and the Naval The multifunctional materials growth and characterization capabilities at WVU rival those found anywhere!

Nanotechnology seeks to exploit the unique properties of materials deliberately designed to be between 1 nm and 100 nm in size. Fundamental nanoscience and engineering (NSE) seeks to develop the basic knowledge needed to develop nanotechnology. An important characteristic of NSE is its intrinsic interdisciplinary nature, because many of the topics of interest require the expertise normally found in different disciplines to gain a full understanding of the problem. In order to study nanoscale structures, however, one must be able to first fabricate them. One of the primary missions of the Multifunctional Materials Laboratory (MML) is to fabricate and characterize nanoscale structures and systems that can serve multiple uses, for example, as both sensors and actuators. Another goal is the study of active interfaces between dissimilar materials to explore new functionality. Currently, the scientists working in the MML are optimizing the growth of ferroelectric thin film layers on wide-bandgap semiconductor thin films with the objective of making new transistor devices as well as active optoelectronic components. The development of ferroelectric quantum structures will play an integral role in this development. Another project involves the study of dissimilar magnetic layers with the aim of obtaining a fundamental understanding about magnetic interactions at surfaces and interfaces.

The MML consists of four room comprising approximately 2500 square feet of clean space and an additional 1000 sq ft of standard lab space housing growth and characterization facilities. NSF EPSCoR funding was leveraged in the construction of approximately one-half the clean space.

Multifunctional Materials MBE Growth Room (Class 1000)
The newest growth capability consists of a unique set of three MBE systems for the fabrication of very thin layers and nanostructures of oxides, nitrides, fluorides, and metals. The different MBE systems are interconnected via a load-locked UHV distribution chamber. Their structure can be assessed by a slew of advanced *in-situ* characterization techniques, including electron diffraction, x-ray dispersive analysis, and cathodoluminescence. There is also LEED, Auger and an Omicron UHV scanning probe microscope in an additional chamber connected in UHV via the distribution chamber. This lab was made possible using NSF instrumentation grants and ONR DURIP funding. There are currently 10 students, postdocs, and technicians that use this facility. The Oxide and Nitride growth chambers were obtained through leveraging NSF EPSCoR funds.

Additional Stand-alone MBE Growth (Class 1000)

- VG-80 Group III-V (including Nitride) System (Refurbished through NSF EPSCoR)
- Seven port custom compact GaN MBE Growth System
- Fifteen port II-VI MBE Growth System

Microscopy Room (Class 10,000)

- Nomarski interference/contrast microscope
- Scanning electron microscopy with EDS capability retrofitted to allow e-beam lithography using NSF EPSCoR Funds
- E-beam compatible resist spinner
- Veeco Multimode Scanning Probe Microscope. This SPM is capable of measuring organic and biological samples in solution, as well as scan in AFM, EFM, MFM, and STM modes.
- Dektak surface profiler

Optical Characterization Room (Class 10,000)

- Photoluminescence system based on Argon ion laser and an 0.3 m spectrometer, 14-400K
- Spectral/Temporal Photoconductivity Measurement System, 14-400K, 10 nS resolution
- Imaging Raman/PL system from Renishaw with sub-micrometer spatial resolution
- Deep Level Transient Spectroscopy and Capacitance-Voltage profiling

Magnetic and Structural Characterization Room (Class 10,000)

- Standard 2θ x-ray diffractometer; 18 kW rotating anode x-ray system (Rigaku) with 4-circle goniometer (Huber); a 2-circle goniometer for x-ray reflectivity measurements (Huber)
- Complete complement of standard x-ray film techniques
- Hall effect and temperature-dependent resistivity (with either a standard electromagnet (1T) or a Janis superconducting magnet (12T)
- Q*uantum Design* SQUID(7 T) magnetometer capable of measuring in the 2 K to 800 K temperature range
- *EGG* vibrating sample magnetometer;
- *M*agnetooptic Kerr effect magnetometer

- An EPR spectrometer from Bruker with sample temperature control from 5 K to 300 K is available through collaboration.

MOCVD Growth Laboratory:

The Metal Organic Chemical Vapor Deposition (MOCVD) laboratory is directed by Korakakis and located in the Engineering Research Building on the Evansdale Campus of WVU. The lab was set up in collaboration with Aixtron Inc. which by virtue of a teaming agreement was able to provide the Lab's MOCVD system at half the cost of its $1.6M value. This relationship enabled the system's purchase through a leveraging of prior RII and university funds.

The MOCVD system has been set up for the growth of III-Nitrides films and heterostructures making the system especially useful for UV – visible optical sources and detectors as well as wide bandgap electronic device applications. The MOCVD gas lines are: hydrogen and nitrogen as carrier gases, ammonia for growth and dilute silane in hydrogen for n-type doping. The MOCVD is also equipped with an EPIRAS system for the thickness and quality monitoring of the epitaxially growing layer. The system is connected to a single phase scrubber to decompose the exhausted ammonia. The capabilities of this system which include wide area (50mm substrate size) device quality growth, high growth rate (1.4 micron/hr), and wide source and epitaxial (and grown) material variety make this system an excellent compliment to the MBE systems of the Multifunctional Materials Lab.

Additionally, for the support of the nitrides growth the following equipment is available in the CSEE department:

- Fourier Transform Infrared Spectroscopy (FTIR)
- Scanning Ellipsometer.
- Deep Level Transient Spectroscopy (DLTS).
- 4 probe measuring station.
- Surface profiler.
- White light spectrometry for thickness measurements.
- Capacitance-Voltage (CV) measuring system.

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Integrated Device and Systems Laboratories

In recognition of the growing importance of embedded systems and the role of biological nanosystems made possible by the cooperation of chemistry, health sciences, physics and electrical engineering disciplines, the core theme binding nearly all research in these labs is the exploration and application of advanced integrated device and system level technologies. Funded programs which populated and use these labs have emphasized the system-level analysis and experimental evaluation of the performance potential of emerging technologies and determination and resolution of compatibility issues which effect their device and system insertion. These labs are located in Computer Science and

Electrical Engineering (CSEE) on the Evnsdale campus of WVU and directed by Hornak and Korakakis.

Shared Nano/Microengineering Shared Cleanroom Facility:
This laboratory provides capabilities for all basic research fabrication, processing and wafer/die preparation, and packaging. Due to its central importance in advancing integrated systems research campus-wide and the role of such a shared facility in the WVNano Initiative, the Provost's office, College of Engineering and the Lane Department have funded the renovation of 4000 sq. ft. of space in the adjacent engineering sciences building for the expansion and upgrade of this lab to a cleanroom facility. This facility, opened in July 2005, has Class 10000, Class 100, and Class 10 areas. Modeled after a similar, highly flexible facility at Bell labs, which gave birth to early optical computing, optical interconnects, and MEMs research, the facility has been equipped using major research instrumentation grants including NSF EPSCoR and donations by AT&T, IBM, and Union Carbide/KTI Chemicals. The lab is used by faculty and students campus-wide and has been a magnet and resource for interdisciplinary work, supporting collaborative research proposals among the departments of physics, chemistry, chemical engineering, pharmacy, and electrical engineering.

Primary lab equipment and resources are listed below. Underlined items were purchased under the prior RII award.

Microlithography (Class 10)
- Laurell Technologies 400 Series Spin Processor
- Karl Suss MA6 Aligner (320/365 nm)
- Research Devices M1 Infrared Aligner (310/365nm)
- LP-III HMDS Primer Furnace
- Blue M box furnace and Thermolyne hotplates for photoresist thermal processing

Wet Processing (Class 100)
- Centralized 18 MegaOhm DI water system
- Eight Foot Acid bench with aspirator and Corning hotplate
- Eight Foot Solvent/Development bench with Thermolyne stirring hotplate and Branson ultrasonic bath

Thermal Processing (Class 10000)
- Thermolyne 6000 Programmable Furnace (1200°C)
- Lindberg/Blue Tube Furnace (1700°C)
- Lindberg/Blue Mini-mite Tube Furnace (1100°C)
- Rapid Thermal Processing System (Purchased)

Dry Processing (Class 10000)
Thin Film Growth and Deposition
- Temescal BJD-2000 Electron Beam Evaporation System with six pocket crucible for metals or dielectrics

- Oxford Instruments Plasmalab 80+ PECVD system (6" wafer max.)
- Tystar Short Tube LPCVD Furnace configured for 6" Phosphorosilicaglass deposition with space for two additional growth tubes
- Lindberg/Blue Quartz Tube Furnace for wet oxidation
- CVC 610 Sputtering Deposition System with 8" target, 2" interchangeable target gun, ion mill and quartz sample heater
- Triple source thermal diffusion/cold trap pumped evaporation system Etching
- Oxford Instruments 80+ Reactive Ion Etcher with ICP head (6" wafer max)

Inspection/Metrology (Class 100 and 10000)

- Tencor Alpha-Step 200 Stylus Profiler
- Zeiss BTL Microscope with film analysis capability
- Leitz Ergolux AMC Microscope

Packaging and Sample Handling (Class 10000)

- Tousimis Autosamdri-815 Liquid CO2 MEMS Dryer (1" wafer/die size)
- West Bond Three Way Convertible Manual Wedge and Ball Bonder (Au or Al wire)
- West Bond Epoxy and Eutectic Die Bonder
- Kullike and Soffa Universal Ball Bonder (Au wire)

Integrated Nano/Micro System Design Laboratory:

Mixed technology integrated system design requires a broad range of tools from physical (electrical, optical, mechanical) modeling to mathematical analysis to final device mask fabrication. This laboratory provides a continually evolving PC based computer aided design environment which supports research and education requiring the design and simulation of integrated electronic, photonic, and MEMS systems. The industry standard CAD tools, PCs and other lab equipment have been obtained through sponsored research. The primary tool-suite includes

- Code-V optical CAD
- OptiFDTD finite element integrated optical CAD
- OptiBPM guided wave optical CAD
- Avanti Technology CAD tool suite (TSUPREM, etc.)
- MAXWELL 2-D Electrostatic Solver
- LASI and LEDIT Mask Design Tools
- MCNC CAMEL MUMPs Standard Cell Library
- Intellisuite Mcirosystem Design Tool
- ANSYS mechanical/physical modeling tool
- Matlab and Simulink
- EBES Mask Design Tool (for Physics Dept. System)

The Photonic and Microelectronic Technologies Laboratory:

This laboratory has extensive capabilities for characterization of electronic, photonic and MEMs devices and systems. The optical and electrical equipment is used to test and measure advanced die, wafer and package based technologies in mixed technology systems. Equipment includes a, two 4 x 8' optical tables, optical breadboards, endfire optical waveguide coupler setup with six axis manipulator with piezoelectric drive, fiber coupler, Metricon optical prism coupler system, video optical waveguide loss measurement system, 35mW and 10mW HeNe lasers, IR viewer and camera, bulk optics and fiber optics, optomechanics, diode laser driver and thermoelectric cooler, optical spectrometer/monochromator, optical power meters, Polytec-PI Laser Doppler Vibrometer System, Digilab FTS 7000 Spectrometer with UMA 600 Microscope and Stingray, Through wafer optical monitoring setup for MEMS motion characterization, Computer controlled C-V, I-V, L, G measurement system, Four Rucker and Coles Probe Stations (Models 680, 666, 660 and 260), closed cycle refrigerator (8K - 300K) with optical and electrical feedthroughs, three Alessi probe stations, semiconductor parameter analyzer, MOS DLTS setup, and misc. test and measurement instrumentation (oscilloscopes, lock-in and current amps, pulse generators, supplies, etc.). This equipment base represents the results of corporate donations and funded program acquisitions including NSF EPSCoR.

WVU Biomolecular Discovery, Design, and Characterization

Biomolecular Core Laboratories

The proposed RII and WVNano Initiative has a significant biological component. Nanoscale devices and systems are to be based on biological molecules. Prior to the construction of these devices, DNA, RNA or proteins will have to be prepared, isolated, purified, and characterized. Subsequent to incorporation and while a part of the device or following device failure, it will also be necessary to characterize the biological component.

DNA, RNA, and proteins can be obtained from commercial sources if they are unmodified. However, for modified DNAs and RNAs, a DNA synthesizer is required. In addition, the preparation of modified DNA and RNA building blocks requires their synthesis in an organic chemistry lab. While we currently lack a protein synthesizer, we can obtain modified proteins in collaboration with faculty at Florida State University. Alternatively, modified proteins can be prepared by site-directed mutagenesis in cells necessitating cell culture laboratory facilities. A third option for proteins is isolation from whole animals (eg myosin) and this requires access to animal facilities.

Once prepared, DNAs, RNAs and proteins must be purified. On a small scale, this can be done by gel electrophoresis. However, we require amounts that are too large for gel methods and usually use a chromatographic method such as HPLC, FPLC or dHPLC for purification. Chromatography is also used in an analytical mode to assess the purity of synthetically or biosynthetically prepared biomolecules. Once purified, DNAs, RNAs and proteins require structural characterization by spectroscopic methods including nuclear magnetic resonance (NMR), circular dichroism (CD), and thermal denaturation. Typically the available NMRs (300 and 600 MHz solution and solids probes) are

sufficient. Access to higher fields is available through on-going collaborations with the National High Field Magnet Laboratory or the University of Minnesota NMR center. The CD spectrometer is capable of the latter two measurements. As part of characterization, molecular weights are determined by mass spectrometry (MS), and the available instruments includes a linear trapping quadrapole Fourier transform MS.

The construction of nanobio-based devices often requires attachment of the biomolecule to a non-biological support. Surface modification and attachment chemistries are often needed and rely on synthetic laboratories for tailored molecules. Once attached, the modified surface is characterized with a variety of methods, including AFM, surface IR, ellipsometry, and confocal microscopy. Other common methods, such as XPS, could be used, but we currently lack this instrumentation. Furthermore, we have developed some novel methods for characterizing biomolecules on surfaces including EPR and SQUID. In the former case, attachment of spin probes to biomolecules allows monitoring with EPR. SQUID is also used here with paramagnetic materials and it has been applied to iron containing proteins that are attached to surfaces. Nanobio devices are also being coupled with electrospray mass spectrometry for detection and identification of proteins.

Finally, molecular modeling methods have been used in conjunction with the preparation and use of nanobiodevices. For example, we have used modeling methods to determine the likely site of attachment of a cytochrome P450 to a gold surface either with or without an intervening linker. This can be via one of five thiols or an amino group. The specific groups involved in the attachment of the cytochrome P450, in turn, affect the enzyme activity. Consequently, we now can tailor enzyme activity based on the method of attachment. Likewise, computational methods have been used to model the EPR spectra of spin labeled oligonucleotides attached to surfaces. The results have been used to optimize conditions for DNA hybridization and to probe DNA-DNA interactions at the surface of nanobio devices.

Below is a table of the equipment used by the biomolecular group and applications for nanobio device development.

Bio-related Equipment and Facilities

Item	**Application**
Atomic Force Microscope (AFM)[1]	Imaging of biomolecules in nanobiodevices
Animal Quarters[2]	Source of proteins (animals). Development of therapeutic nanoparticles
Computational Biology Laboratory[2] and Beowulf Custer[3]	Modeling of biomolecule conformation and attachment
CD Spectrometer[2]	DNA, RNA, Protein characterization, structure
Cell Culture[2]	Biosynthesis of proteins for nanobio devices
Chromatography[2]	Purification of biomolecules for nanobio devices.

Confocal Microscopy[2,4]	Imaging of biomolecules in nanobiodevices or nanoparticles in biological systems
DNA Synthesizer[2]	Preparation of DNA or RNA oligomers for nanobiodevices
ElectronParamagnetic Resonance (EPR) spectrometer[1,2]	Imaging of spin-label biomolecules in nanobio devices
Flow Cytometer[2]	Imaging of nanoparticles in cells, selection of labeled nanoparticles
Mass Spectrometry[2,4] Thermo Finnigan LTQ-Fourier Transform Mass Spectrometer[2]	Characterization of biomolecules, detector in nanobio devices
Nuclear Magnetic Resonance Spectrometers [2,4] (600 MHz NMR, Liquid/Solid) [2]	Characterization of biomolecules
Magnetic Resonance Imager (MRI, 3T) and Positron Electron Transmission (PET) spectrometer[2]	In Vivo imaging of nanoparticles
Scanning Probe Microscope(SPM)[2]	Imaging of biomolecules in nanobio devices
Scanning Electron Microscope (SEM)[2]	Imaging of biomolecules in nanobio devices
Superconducting Quantum Interference Device (SQUID)[1]	Detection of biomolecule interactions on surfaces/in nanobiodevices
Synthesis Laboratories[2,4]	Preparation of modified DNA, RNA, Proteins, linkers, surface preparation

[1]Location: Department of Physics
[2]Location: Health Sciences Center (HSC)
[3]Location: CRRB
[4]Location: Department of Chemistry

Microfluidic System Fabrication

The following tool set for microfluidic system fabrication is under the supervision of Timperman in Chemistry on the Downtown Campus of WVU.

- Oxford Lasers MP100UV Laser Micromaching System for direct writing of high aspect ratio channels and features in, glass, plastics, and metal microsystems.
- High Pressure Wafer Washing for cleaning glass microfluidic substrates prior to bonding.
- Acid/Piranha wafer/substrate cleaing station.
- Programmable muffle furnace for thermal bonding of substrates.

Comparison with NNUN Nodes' Baseline Equipment

In order to assess our progress and current status in baseline facilities, we compare our capability with that at NUNN Nodes. The list contains only equipment listed by the NNUN Nodes, i.e. not equipment that is available at WVU, and is relevant to nanotechnology, but not used in any nodes, e.g. XRD, Quadropole Time of Flight Spectrometer etc. This list represents the capabilities qualitatively, not quantitatively. Nodes typically have more than one option for each process, for example UCSB has more than one thermal evaporators. This is not reflected on the list.

Equipment	Penn St.	Cornell	Stanford	Howard	UCSB	WVU
4 probe station		x			x	x
AFM		x	x		x	x
Alpha Step		x	x		x	x
Annealing Surfaces	x	x	x			x
Auger		x		x		x
Bonders		x	x		x	x
CAD		x		x		
CV Testing		x				x
DLTS				x		x
E-beam Direct Write	x		x			
E-beam evaporator	x			x		x
E-beam Lithography	x	x	x		x	
Electrochemical Profiler				x	x	
Elipsometer		x	x		x	x
Hall Effect				x	x	x
Ion Implanter	x	x		x		
Ion Milling		x		x		
IV probe station		x			x	x
LPCVD	x		x	x		x
MBE				x		x
MOCVD				x		x
Optical Lithography	x	x	x	x	x	x
Optical Microscopy	x				x	x
Oxidation Furnaces	x	x	x			x
PECVD	x	x	x		x	x
PL				x		x
Resistivity Mapping			x			
RIE	x	x	x	x	x	x
RTA	x		x	x	x	
SEM	x	x	x	x	x	x
SIMS				x		
Sputtering			x		x	x
Stress Measurement			x			
Thermal evaporator	x		x	x	x	x

Notes:

1. Source: http://www.nnun.org

MU
Biomolecular Discovery, Design, and Characterization

Imaging Laboratory:
The imaging facilities are directed by Dr. Michael Norton. They provide the opportunity to image various type of biological samples from single cells to tissue, all the way to single molecules (DNA, DNA-protein complexes).

- Thermomicroscope Explorer Atomic Microscope with 3rd Tech DP-1000 NanoManipulator
- JEOL Environmental SEM with Oxford EDX
- Biorad Confocal Microscope
- Digital Instruments Nanoscope II Scanning Tunneling Microscope
- General Electric XRD6 and SPG -X-ray Diffraction and X-ray Spectrometer
- Digital Spot Camera G3
- Nano-R Atomic Force Microscope (AFM) for 110V AC
- Kodak X-OMAT 1000A Film Processor
- VWR Model 1156 Circulating Chiller
- BX51 Microscope System
- OSF-0025 TXRD Filter set
- Arc Lamp source and parts
- Imaging Spectrometer

Computational Core Facility:

- Silicon Graphics Origin 200 4 Processor Server
- Silicon Graphics Octane Workstation
- Silicon Graphics 02 Workstation
- DEC 433 AU Workstation
- Numerous Macintosh G4, G3 and WinTel Machines in Labs and Graphics Facility
- Software includes Gaussian 98, Q-Chem, MSI Discover and Insight, GAMESS, HyperChem, Chem 3D Pro, MathCad, Excel, etc.

Nuclear Magnetic Resonance:

- Oxford Wide Bore 300 MHz Magnet with TecMag Discovery Console and DOTY MAS probe for imaging and solids
- Varian Unity + 500 MHz
- Varian XL 200 NMR Spectometer with Motorola Update (2 available)
- Varian 60 MHz w/Fourier Transform Upgrade
- Gradient Shim Set

DNA and Functional Genomics Core Facility:
The DNA sequencing and genomics facilities are hosted at the MU Joan C. Edwards School of Medicine under the direction of Dr. Donald Primerano. The microarray facility is under the supervision of Dr. Goran Boskovic.

- ABI 3130 Genetic Analyzer

- Genomics Solutions Microarray Hybridization Station
- Perkin-Elmer Scanarray Express Microarray Scanner
- Applied Biosystems Sequence Detection System (real time PCR)
- BioRad iQ Icylcer Real time PCR
- Nano Drop Spectrophotometer
- Hewlett Packagrd Model 2100 Bioanalyzer (microchannel nucleic acid analysis)
- Four MJ Thermal Cyclers (conventional PCR)
- Mini Flurometer

Proteomics Laboratory

The proteomics laboratory is located in the Department of Chemistry.
Mass Spectrometry:

- Bruker biFlex III w/Scout 384 Matrix Assisted Laser Desorption Ionization Time of Flight (MALDI-TOF) Mass Spectrometer
- Finnigan LCQ w/Electrospray and Atmospheric Pressure Chemical Ionization
- Varian Saturn 2000 GC-MS with Flame Ionization Detector and Electron Impact
- Finnigan ITC with Teledyne Apogee upgrade
- Proteomic Protein Picker
- 34 mm Imaging Probe/Pkg

Protein Purification:
Several units of equipment necessary for protein purification are present at MU. The departments of Biological Sciences, chemistry and the School of Medicine possess independent protein purification units. MU faculty have access to the equipment listed below:

- Micro-Tech 2-DUltra-Plus micro HPLC and CE/CEC
- HP 1090 Liquid Chromatograph w/Hewlett-Packard Chemstation Controller
- HPLC BioRad BioLogic DuoFlow
- Chromatography refrigerator

Structure and function:
The structure-function group provides capabilities for basic research on conformational changes undergone by protein or protein-DNA complexes under various experimental conditions. The quantitative Agarose Gel Electrophoresis units are utilized to study DNA compaction induced by protein binding. The optical system permits the detection of rapid molecular structural changes through photo-acoustic measurements. The instruments are used by faculty and students and provide a unique resource for biophysical measurements of DNA and protein structural transitions.

- Aquebogue Quantitative Agarose Gel Electrophoresis Units (3)
- Duo Flow
- Video Phototube and Mount
- MZ6 Optics Carrier
- Mini Flurometer

General Equipment:
The various pieces of equipments are located in various laboratories in the Departments of Biological Sciences and Chemistry.

- RoboCycler 96 Gradient cycler (2)
- UV Crosslinker 115V 60HZ
- Hybridization Oven
- Beckman L7 Ultracentrifuge (2)
- Beckman Coulter Avanti J-25 centrifuge
- Bacterial culture incubators (2)

Item	**Application**
Atomic Force Microscope (AFM)[1]	Imaging of biomolecules and biodevices
Animal Quarters[2, 3]	Source of tissues, proteins (to be purified)
Cell Culture[2, 3] + Cell Sorter (flow cytometer) [2]	Analysis of cell population from culture
Chromatography[1, 2, 3]	Purification of biomolecules and bio complexes
Confocal Microscopy[2, 3]	Imaging of biomolecules in biological systems
Nano Drop [1,3]	Capable of quantitation of biological samples in small volumes
ABI Automated DNA Synthesizers[3]	Synthesize oligonucleotides
Genomics Solutions Microarray Hybridization Station [3]	Performs hybridization of labeled cDNA to microarray probes
Perkin-Elmer Scanarray Express Microarray Scanner[3]	Scans microarray slides and spots intensity quantitation
Mass Spectrometry[1]	Characterization of biomolecules
Protein Purification[1, 2, 3] facilities and ultar-centifuges[2, 3]	Preparation of homogeneous proteins
DNA Labaoratory[3]	DNA sequencing

[1] Location: Department of Chemistry
[2] Location: Department of Biological Sciences
[3] Location: School of Medicine

West Virginia University
Office of the Vice President for Research and Economic Development

September 13, 2005

Dr. Sherry Farwell
Head, NSF EPSCoR Program
The National Sciences Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Dr. Farwell:

West Virginia University is taking active measures to increase its competitiveness in mainstream research and to connect that research to economic development. As part of this effort, the West Virginia University Research Corporation has made a five-year commitment to fostering nanoscale science, engineering, and education research. More specifically, West Virginia University has initiated a comprehensive program known as the WVNano Initiative and the proposal to the NSF EPSCoR infrastructure is a major piece of this Initiative. The WV EPSCoR proposal with a proposed start date of May 1, 2006, contains a greater than 58% match from the State of West Virginia.

The West Virginia University Research Corporation has committed a total investment of more than $8.3M over the three-year duration of the project as a match. This is in addition to the guaranteed match of $4.5M provided by the State of West Virginia. This investment will ensure the sustainability of the infrastructure improvement and guarantee the success and competitiveness of the next generation of molecular biometrics outlined in this proposal that will significantly contribute to the economic development of the state of West Virginia.

Thank you for considering the state EPSCoR Infrastructure proposal.

Sincerely,

John D. Weete
Vice President for Research and Economic Development, and
President, West Virginia University Research Corporation

Research Office

886 Chestnut Ridge Road, Room 708
Phone: 304-293-3449 | PO Box 6216
Fax: 304-293-7498 | Morgantown, WV 26506-6216

JOE MANCHIN III
GOVERNOR

STATE OF WEST VIRGINIA
DEPARTMENT OF EDUCATION AND THE ARTS
OFFICE OF THE CABINET SECRETARY
STATE CAPITOL BUILDING 5, ROOM 205
1900 KANAWHA BOULEVARD, EAST
CHARLESTON, WV 25305

KAY GOODWIN
CABINET SECRETARY

September 14, 2005

Dr. Sherry O. Farwell, Office Head
NSF EPSCoR
1122 S
4201 Wilson Boulevard
Arlington, VA 22230

Dear Dr. Farwell,

As Chairman of the West Virginia State EPSCoR Advisory Council, I am very pleased to write a letter in strong support of our state's 2005 Research Infrastructure Improvement (RII) grant proposal.

The recent history of EPSCoR in West Virginia has been a positive one. Thanks to courageous and decisive steps taken by both the Executive and Legislative branches of state government during the last five years, EPSCoR is the focal point of our state's efforts to build research capacity and stimulate economic development. Thanks to the leadership of Dr. Paul Hill and the work of his staff, EPSCoR is serving more West Virginia institutions, researchers, and students than ever before with an unprecedented range of grant and outreach programs. As we submit this proposal for three additional years of NSF support, we do so with pride in what we have accomplished thus far and with hope for achieving our potential in the future.

Perhaps our greatest source of hope is the strategic plan that we, as an Advisory Council, developed as part of this year's EPSCoR activities. The Council, which is broadly representative of academic, business, and government interests on a statewide level, is committed to promoting this plan and reaching the goals we have established for ourselves in six key areas: financial resources; education and outreach; research and innovation; human and physical infrastructure; economic development; and public policy.

We also have the continued support of our Governor and Legislature in implementing this strategic plan. In his first State of the State Address, Governor Manchin clearly expressed the importance of research to our state's economy and the need for collaboration between our two research-oriented universities. His 2005 legislative agenda reinforced these points. The Senate Education Chairman, Robert Plymale, is a tireless and effective champion of the EPSCoR program and its mission. Working with

PHONE: (304) 558-2440 FAX: (304) 558-1311

these and other elected leaders, the Council has built a powerful consensus around the contents of our strategic plan and a course of action.

At the heart of our efforts is the RII grant. The RII grant from 2002 was essential in leveraging the first major state investment in research: the Research Challenge Fund (RCF). In fiscal year 2005, this fund generated more than $4 million in state funds in support of research, education, and outreach. Because the RCF is a dedicated revenue stream, we can count on this funding every year and this enables us to make the multi-year commitments necessary for new facilities and equipment, faculty hires, and graduate student recruitment—all of which are integral to our strategic plan.

Through the RII grant and the RCF, West Virginia has achieved a position of national prominence in biometrics. Given the importance of biometrics to homeland security, federal and private investment in this field will only increase. With a new RII that builds on the success of our existing grant, West Virginia can seize the opportunities created by these investments and become an international leader. This is our hope; this is our goal. Anything less is a betrayal of the hard work and dedication of faculty and students who are creating the future every day in our state's classrooms and laboratories.

I began this letter with a reference to my role as Chairman of the EPSCoR Advisory Council. I will conclude by stating that I am a West Virginian who is proud to have been a part of the "research renaissance" of the last five years. There is a new excitement in West Virginia about what we can accomplish and how we can compete in a knowledge-driven economy. We need to maintain our momentum and sustain the excitement. I believe this RII proposal complements our strategic plan and together, these are the blueprints for West Virginia's future. I appreciate your consideration of this application.

Sincerely,

Kay Goodwin

Kay Goodwin
Cabinet Secretary

State of West Virginia
Joe Manchin III
Governor

Office of the Governor
State Capitol
1900 Kanawha Blvd., East
Charleston, WV 25305

Telephone: (304) 558-2000
Toll Free: 1-888-438-2731
FAX: (304) 342-7025
www.wvgov.org

To the EPSCoR RII Review Panel:

In 2001, West Virginia rededicated itself to reforming and revitalizing our state EPSCoR program. The hiring of a new Executive Director, the reorganization of the state EPSCoR Office, and the creation of a new, more broadly representative state EPSCoR Advisory Council were the most significant steps taken to address issues of program accountability, efficacy, and sustainability. These steps resulted in a better-governed and more competitive West Virginia EPSCoR.

In recognition of the renewed credibility and capacity of the EPSCoR Program, in 2004 the Governor and Legislature created the Research Challenge Fund. This fund allocates 0.5% of annual video lottery revenue (which amounted to $4.3 million in FY 2006) to WV EPSCoR in support of state match for NSF funds, research projects, graduate and undergraduate education in scientific and technical fields, and K-12 education outreach. The creation of this designated fund for research and giving the EPSCoR program authority over it are the most compelling demonstrations of state policymakers' confidence in EPSCoR as the most effective point of coordination for building research capacity in West Virginia.

National Science Foundation support has been essential to the progress we have made over the last four years. Without the Research Infrastructure Improvement grant we received in 2001, there would have been no Research Challenge Fund in 2004. We managed NSF's initial investment well, and leveraged it to secure a much-needed state investment in research. The combined federal and state investments in research since 2001 have enabled West Virginia to become a respected leader in biometrics. Today, our state is poised to take the next step toward national competitiveness and leadership in this very important field. NSF support, in the form of a new RII grant that will allow us to build on our past accomplishments and existing strengths, is critical to our future.

As Governor, I have made increased collaboration between our state's two research-oriented universities a top public policy priority. In my first State of the State Address, I made my expectations clear: "Our two largest universities, Marshall and West Virginia

University, are keys to this competitiveness. Alone, each can accomplish much. Together, they can accomplish much more. At my direction, West Virginia University and Marshall University will be working in a new spirit of collaboration to promote the state's economic interests....[W]e also expect them to be partners in creating new jobs, conducting scientific research, and generating high-tech economic development."

I consider our EPSCoR program is a prime example of genuine, effective collaboration between these two universities. I also regard EPSCoR as an integral part of our state's economic development plan. For both of these reasons, I place a high level of importance on the success of our EPSCoR program. I encourage and expect the appropriate members of my Administration—from the Director of the Economic Development Office to the Cabinet Secretary of Education and the Arts and my education policy advisor—to be directly and actively involved in promoting EPSCoR and creating new opportunities to expand our state's research capacity. Nothing is more important to West Virginia's ability to compete in the 21st century economy.

I appreciate NSF's consideration of West Virginia's RII proposal, and I look forward to learning of our success in this grant competition.

Sincerely,

Joe Manchin III

MARSHALL UNIVERSITY
www.marshall.edu

Office of the President

September 16, 2005

Dr. Sherry O. Farwell
Head, NSF EPSCoR Program
The National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Dr. Farwell:

As the new President of Marshall University, I wholeheartedly confirm the resource commitments to WVEPSCoR's 2005 RII proposal recommended by the institution's senior vice president for finance, the provost and senior vice president for academic affairs and vice president for research.

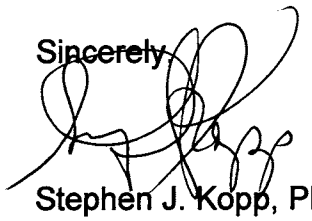
As a PhD physiologist, one of the things that attracted me to Marshall was its strategic vision for research development – one based on advancement of interdisciplinary basic research involving the our School of Medicine, College of Science and Forensic Science Center. Toward that vision, Marshall now has over $65 million invested in new construction. By fall 2006, we will open a new basic science building with over 75,000 net square feet (nsf) of state-of-the-art research and educational space. In this same period, we will open a new cancer center with over 16,000 nsf of translational research space. Our next step is to fill these new facilities with nationally competitive investigators. This will be achieved by adding NIH- and NSF-funded investigators to our current pool of in-house talent.

Marshall's research talent is being developed in the School of Medicine through a 5-year, $9.3M COBRE award from the NIH and in the College of Science through NSF's RII program. We are requesting $1.6M from the NSF in this RII proposal to foster the research development of junior faculty in the College. Marshall has committed $1.9M as match to this proposal with $1.6M as cash match. In addition, over $1.4M of state Research Challenge Funds are committed to this RII proposal.

I have met the junior faculty members from the College of Science included in the RII proposal. I believe with the help of NSF EPSCoR funding we can provide the environment and senior mentorship necessary to bring these faculty to a competitive level. Toward these goals, Marshall will hire two full-time teaching faculty and 10 teaching assistants to give our junior faculty sufficient time for research. We will also supply stipends for doctoral students to add bright minds and eager hands to the research effort. Senior mentorship will be enhanced by national searches this fall for a new dean of the College of Science, a new division head for biological sciences and a mid-career scientist in cell division and differentiation. The division head and mid-career scientist will have NSF and/or NIH funding and will be expected to retain their research activities in order to lead the College's research development by example. In addition, Marshall University plans to create nine endowed professorships for its new Institute for Interdisciplinary Research (IIR). The interdisciplinary research areas of the IIR – biomedical, environmental and forensics – will complement the long-term health and security applications of this RII proposal. The IIR will reside in the new basic science building where nationally recognized researchers will collaborate with Marshall's competitive investigators and its maturing RII and COBRE faculties. This is my top priority, as I believe the environment created in a nationally competitive IIR is the final element in Marshall's evolution to a research-intensive university.

Marshall owes a major portion of its current opportunities to infrastructure grants like the RII and COBRE. I pledge my commitment to this proposal and the long-term growth of Marshall's competitive research posture.

Sincerely,



Stephen J. Kopp, Ph.D.
President

WEST VIRGINIA STATE UNIVERSITY

Office of the President
P.O. Box 399
Institute, West Virginia 25112
(304) 766-3111
Fax (304) 768-9842

September 16, 2005

Dr. Sherry Farwell
Head, NSF EPSCoR Program
The National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Dr. Farwell:

I am extremely pleased to write in support of the West Virginia EPSCoR RII proposal. West Virginia State University regained its 1890 Land Grant status in 1999. With this status, we are building a more competitive science program. Our new biotechnology masters program is growing, and both students and faculty are excited about opportunities that will arise from EPSCoR support.

West Virginia State University, in collaboration, with West Virginia University and Marshall University has proposed to expand and strengthen recruitment and retention of underrepresented students in science, technology, engineering, and mathematics (STEM). We also will provide opportunities for our science faculty to expand their expertise in disciplines related to molecular biometrics. An initiative to manage all STEM student and STEM grant programs under a single office is underway, and we will integrate this initiative with enhanced STEM student and faculty success with the assistance of NSF EPSCoR.

The support, we will receive from this RII, will help in the evolution of West Virginia State University from a primarily teaching institution to one with a better balance between teaching and research. Our commitment to this vision and this proposal includes dedication of the time of administrative, faculty, and technical personnel, including a portion of salary and fringe benefits for the STEM program outreach and research coordinator. We will also provide all supplies and institutional office space for RII program activities. Our in-kind contribution to the goals of the RII proposal totals **$204,060.**

This RII proposal is a vital foundation for the expansion of our science research and outreach programs. Mr. Joseph Kusimo is on the Executive Leadership Team for this grant and will be the WVSU EPSCoR coordinator to assure that the proposed activities are successful. West Virginia State University is pleased to partner with WVEPSCoR in this proposal and with the opportunities provided by NSF EPSCoR and the RII grant program. This multi-university collaboration will benefit many citizens of WV.

Sincerely,

Hazo W. Carter, Jr.

Hazo W. Carter, Jr., Ed.D.
President