

**02 INFORMATION ABOUT PRINCIPAL INVESTIGATORS/PROJECT DIRECTORS(PI/PD) and  
co-PRINCIPAL INVESTIGATORS/co-PROJECT DIRECTORS**

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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):**

**REQUIRED: Check here if you are currently serving (or have previously served) as a PI, co-PI or PD on any federally funded project**

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**Ethnicity Definition:**

**Hispanic or Latino.** A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.

**Race Definitions:**

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**PI/PD Name:** John Maher

**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)  
 Hearing Impairment  
 Visual Impairment  
 Mobility/Orthopedic Impairment  
 Other  
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**Citizenship:** (Choose one)  U.S. Citizen  Permanent Resident  Other non-U.S. Citizen

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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)  
 Hearing Impairment  
 Visual Impairment  
 Mobility/Orthopedic Impairment  
 Other  
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**PI/PD Name:** Jose Ulises Toledo

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

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### **SUGGESTED REVIEWERS:**

Not Listed

### **REVIEWERS NOT TO INCLUDE:**

Not Listed

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## 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 09-29					<b>FOR NSF USE ONLY</b>	
NSF 09-570			10/19/09		<b>NSF PROPOSAL NUMBER</b>	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)					<b>1003907</b>	
<b>EPS - RESEARCH INFRASTRUCTURE IMPROV</b>						
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION	
10/16/2009	2	01120000 EPS	7217	928636323	10/16/2009 12:52pm	
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES, LIST ACRONYM(S)		
550517092						
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE			ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE			
Higher Education Policy Commission			Higher Education Policy Commission 1018 Kanawha Blvd East Suite 700 Charleston, WV. 253012841			
AWARDEE ORGANIZATION CODE (IF KNOWN)						
6250004980						
NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE			ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE			
PERFORMING ORGANIZATION CODE (IF KNOWN)						
IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)		<input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> FOR-PROFIT ORGANIZATION		<input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS		<input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE
TITLE OF PROPOSED PROJECT <b>Bionanotechnology for Public Security and Environmental Safety</b>						
REQUESTED AMOUNT \$ <b>20,000,000</b>	PROPOSED DURATION (1-60 MONTHS) <b>60</b> months	REQUESTED STARTING DATE <b>07/01/10</b>	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE			
CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW						
<input type="checkbox"/> BEGINNING INVESTIGATOR (GPG I.G.2)		<input type="checkbox"/> HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____				
<input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)		Exemption Subsection _____ or IRB App. Date _____				
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)		<input type="checkbox"/> INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)				
<input type="checkbox"/> HISTORIC PLACES (GPG II.C.2.j)		_____				
<input type="checkbox"/> EAGER* (GPG II.D.2) <input type="checkbox"/> RAPID** (GPG II.D.1)		<input type="checkbox"/> HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)				
<input type="checkbox"/> VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____		PHS Animal Welfare Assurance Number _____				
PI/PD DEPARTMENT <b>Division of Science and Research</b>		PI/PD POSTAL ADDRESS <b>1018 Kanawha Boulevard East Suite 1101 Charleston, WV 253012841 United States</b>				
PI/PD FAX NUMBER <b>304-558-2321</b>						
NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address		
PI/PD NAME <b>Paul L Hill</b>	<b>PhD</b>	<b>1983</b>	<b>304-558-4128</b>	<b>paul.hill@wvresearch.org</b>		
CO-PI/PD <b>John Maher</b>	<b>PhD</b>	<b>1986</b>	<b>304-696-4837</b>	<b>maherj@marshall.edu</b>		
CO-PI/PD <b>Curt M Peterson</b>	<b>PhD</b>	<b>1970</b>	<b>304-293-7537</b>	<b>cmpeterson@mail.wvu.edu</b>		
CO-PI/PD <b>Jan Taylor</b>	<b>PhD</b>	<b>1985</b>	<b>304-558-4128</b>	<b>jan.taylor@wvresearch.org</b>		
CO-PI/PD <b>Jose Ulises Toledo</b>	<b>PhD</b>	<b>2001</b>	<b>304-766-3000</b>	<b>toledoju@wvstateu.edu</b>		

## CERTIFICATION PAGE

### Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the Authorized Organizational Representative or Individual Applicant 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), nondiscrimination, and flood hazard insurance (when applicable) as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG) (NSF 09-29). 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).

#### Conflict of Interest Certification

In addition, if the applicant institution employs more than fifty persons, by electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative 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 the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.A; 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 Exhibit II-3 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 Exhibit II-4 of the Grant Proposal Guide.

#### Certification Regarding Lobbying

The following 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.

#### Certification Regarding Nondiscrimination

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

#### Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

- (1) community in which that area is located participates in the national flood insurance program; and
- (2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:

- (1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
- (2) for other NSF Grants when more than \$25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE		SIGNATURE	DATE
NAME <b>Terry L Hess</b>		<b>Electronic Signature</b>	<b>Oct 16 2009 12:46PM</b>
TELEPHONE NUMBER <b>304-558-0679</b>	ELECTRONIC MAIL ADDRESS <b>hess@hepc.wvnet.edu</b>	FAX NUMBER <b>304-558-0259</b>	

\* EAGER - EARly-concept Grants for Exploratory Research

\*\* RAPID - Grants for Rapid Response Research



## PROJECT SUMMARY

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**Research Vision and Strategy.** The proposed RII is the strategic framework for an integrated effort that will position West Virginia (WV) to achieve measurable growth in bionanotechnology, an area of importance in diversifying and transforming WV from an extractive industrial base to a more high-tech knowledge-driven economy. The specific goal is to provide necessary infrastructure to stimulate innovative research while integrating education, workforce development and diversity programs focused on *bionanotechnology for enhanced public security and environmental safety*.

The interdisciplinary research effort is led by West Virginia University (WVU), Marshall University (MU), and West Virginia State University (WVSU). Also engaged in research and workforce development (WFD) activities are the state's Predominantly Undergraduate Institutions (PUIs) and Community and Technical Colleges (CTCs). Our vision is a nationally recognized and sustainable Center in bionanotechnology that integrates research and education and advances knowledge through innovative collaborations while vitalizing the economy of the state. The proposed effort builds on significant expertise developed during the past four years -- new faculty hires, shared experimental facilities, and development of comprehensive student research programs.

WVEPSCoR's RII proposal is fully aligned with *Vision 2015*, the state's science and technology plan, in which research and innovation are key drivers of WV's new, diverse and competitive economy. Over the last six years, the State has launched a series of initiatives to achieve this vision and has received unwavering support from Governor Joe Manchin, cabinet secretaries, the legislature, academia, industry, and community groups. This collective support has led to the *Research Trust Fund* and the *Eminent Scholars* initiatives which have brought leading researchers to the state and the PROMISE and HEG scholarships that provide more than 18,000 college students free in-state tuition. Two other major initiatives are the HEPC Diversity Initiative and the Governor's Workforce Program, both integral to *Vision 2015* goals and this RII proposal.

**Strategy:** This RII proposal supports a number of integrated activities to enhance the competitive position of WV S&T. Specific infrastructure investments include: 1) investing in Interdisciplinary Research Teams (IRTs) through new hires and advanced equipment to design and fabricate critical components for next-generation devices to exploit opportunities in molecular recognition and cell-based platforms; 2) seeding new research opportunities in cellular biology to leverage established and ongoing investments in bionanotechnology, thereby providing tools to explore cells and their environment at the nanometer scale; 3) enhancing student and faculty diversity by implementing a system-wide diversity action plan, the core of which is a WV<sup>3</sup> Think Tank charged with bringing together key scientists and educators to direct, integrate, and fill gaps in currently funded K-20 programs; 4) providing workforce training and development opportunities to a diverse group of students and institutions through a new PUI/CTC Incubator, piloting a business-science M.S. program and engaging the private-sector through internships and entrepreneurial coursework; 5) enhancing cyberinfrastructure (CI) by providing researchers with advanced tools to predict nanoscale behavior; 6) improving student retention and science teacher recruitment and competency through a pilot program, Teacher Research Experience for Advancing Knowledge (TREK) and a Learning Assistants (LA) program tied to research activities; and 7) providing underrepresented minority, disabled persons, first-generation college students and women the tools to be successful in future careers through a new graduate fellowship program. To enhance research activities and move toward a Center, regional collaborations will be enhanced with universities and centers of excellence with complementary strengths and needs, such as NIOSH, Carnegie Mellon University, and the NSF-IUCRC, Center for Identification Technology Research, and its affiliates, e.g., DoD the FBI, and various industrial partners.

**Research Infrastructure and Research.** Scientific and engineering research focuses on development of fundamental knowledge needed for field-deployable sensors that can monitor, in real-time, presence of

specific heavy metals, pathogens, and other environmental threats. Research is focused on creating tools with real-time readouts and validating those against existing standards to ensure utility. Three IRTs will be formed - IRT 1 *Portable and Rapid Identification Platforms*, IRT 2 *Field-deployable Microfluidic Electrochemical Sensors for Multiplexed Detection of Heavy Metals and Small Molecule Toxins* and IRT 3 *Ex Vivo and In Vitro Biomimetics for Cellular Response Monitoring*. IRTs include faculty with complementary expertise to create new platforms for integrated devices. They will solve several fundamental science and engineering problems including the interconnects between sensor elements and underlying chip architecture; developing microfluidic devices with downstream nanosensors; and integrating viable cells in a microfluidic chip where metabolism will be measured using calibrated nanosensors. Proposed IRT research will benefit from prior infrastructure investments, new faculty hires and significant upgrades of bioengineering research facilities at WVU. Equipment to fabricate hybrid integrated biological/solid state microfluidic, optical and electronic devices will be housed in new and satellite facilities and sustained by integration with existing Shared Facilities. New CI will support IRT research in computing atomistic classical force fields, newly developed coarse-grain modeling techniques, or density-functional theory for validation and prediction of experimental measurements related to biological/inorganic interfaces, micro/nanofluidic flow and photonic crystals among others.

**Human Resource Development: Diversity.** The following activities will be carried out: 1) implement a system-wide Diversity Plan modeled after successful programs that will set goals and outcomes for developing and supporting enhanced strategies for diversity in HEPC institutions; 2) create the WV Innovation through Institutional Integration (WVI<sup>3</sup>) *Think Tank* to integrate current programs addressing retention, diversity and WFD; 2) sustain need-based HEG scholarships for underrepresented groups; 3) institutionalize the faculty diversity enhancement program; 4) strengthen articulations between CTCs and universities; and 5) sustain and leverage existing state-wide student retention initiatives. This RII proposal will increase institutional diversity by actively engaging the States' 16 PUIs and 10 CTCs through the PUI/CTC Incubator program. **Workforce and Education.** WVEPSCoR will support the Governor's Task Force to identify industry needs and skill sets and integrate these with HEPC's Diversity Initiative. Education activities will: 1) extend current STEM research educational programs to K-12 educators (TREK, LA, and existing Noyce Scholars program at WVU); 2) continue the state's scholarship programs; 3) institute a PUI/CTC Incubator program that provides merit-based awards to PUI and CTC faculty and their students to collaborate with faculty at WVU and MU; 4) provide M.S. students in biotechnology at MU and WVSU an option for a business minor; and 5) initiate Summer High Performance Computing (HPC) Institute at WVU.

**Cyberinfrastructure.** CI efforts will support the broad goals and specific objectives of *Vision 2015* to expand an advanced network infrastructure, HPC and data storage resources and install advanced tools for the research community. These efforts also support linkages to other WV and Federal initiatives, particularly the recent NSF funded WV/AR Track II, to establish an education and training program for cyber-enabling the workforce. This RII will add 512 cores to expand the Shared Computational Facility to a total of 768 to meet computational and modeling needs across the state. It establishes a path to grow CI-enabled research and discovery and serves as a magnet for future computational research group hires. Other initiatives include: 1) conducting Summer HPC Institutes for PUIs and CTCs; 2) linking Instrumentation via Distance Access for remote operation of major instrumentation; and 3) developing a Virtual Collaboratory as a portal to share CI-enabled instrumentation for faculty and students at institutions statewide as well as IRT team collaboration.

**External Engagement.** External engagement and outreach plans include programs targeting a variety of communities and designed to impact a significant number of students at all levels. Other outreach and communication initiatives include: 1) publishing *The Neuron* which highlights WV STEM research and economic development; 2) hosting, in partnership with Cornell University, a traveling nanotechnology

exhibition *Nanooze*; 3) continuing the biennial statewide STaR Symposium; 4) enhancing WVEPSCoR's website with a "Discovery" tab highlighting WV research discoveries and a Press Room to facilitate media and 5) contracting with MetroNews Networks for a statewide S&T awareness campaign.

**Evaluation.** A comprehensive evaluation and assessment plan will be led by Dr. Rose Shaw and utilize qualitative and quantitative approaches to provide both formative feedback and summative assessment. Process use (self-assessment, collective knowledge generation and collaborative action) will survey institutional perspectives and will create a learning process for the management team to build capacity, sustainability and institutionalization. The RII management team will make informed decisions using the evaluative data in consultation with the External Technical Advisory Board (ETAB). **Sustainability and Emerging Area.** We will sustain our infrastructure improvements by: 1) retaining new hires and maintaining equipment with State and university funds; 2) continuing efforts to increase the Research Challenge Fund (RCF); 3) increasing the number and competitiveness of individual, group and large-scale, multidisciplinary proposals; 4) building stronger research collaborations; 5) creating university-wide undergraduate research education offices; and 6) developing a post-doc and junior faculty mentoring system that will increase success of all faculty. **Seed Funding for High Risk/High Impact Research** will support: 1) efforts to acquire preliminary data for transformative projects ; 2) competitive researchers changing directions; 3) junior faculty pursuing NSF CAREER awards; and 4) innovative educational/research alliances with industry. Merit-based seed grants will provide Summer salary for up to two investigators, funding for two graduate students, materials, supplies and travel.

**Management.** The management team is led by RII PI and State Director, Dr. Paul Hill. Co-PIs include Drs. Jan Taylor, WVEPSCoR Deputy Director, who will oversee evaluation and assist in program management, campus EPSCoR Coordinators Curt Peterson, WVU VP Research, John Maher, MU VP Research, and Ulises Toledo, Assoc. Dean & Director, Business and Research, Land-Grant Institute at WVSU. Drs. David Lederman (WVU), and Elmer Price (MU) serve as technical coordinators. A new WVU senior faculty member/permanent director will help lead overall day-to-day aspects of the effort. The PI will interface with the NSF Program Officer and other agency personnel over the course of the RII.

**Intellectual Merit:** There are fundamental scientific and engineering problems associated with enhancing public security within the realm of field-deployable sensors. Because of strides made in collaborative research within the current RII, IRT scientists are poised to resolve fundamental technical barriers in development of effective, field-deployable, real-time sensors for identification of specific environmental security threats. Integration of fluidic, electronic, biomimetic and optical characterization and transport tools will be instrumental in transforming basic science discoveries in bionanotechnology to applied problems in national security. Basic research pursued by faculty, staff and students will range from theoretical to applied and includes disciplines and experts in fields such as physics, computer science, electrical engineering, biochemistry and biology. This focused investigation on the frontiers of sensor development, supported by new shared bioengineering facilities and high performance computing cyberinfrastructure, will improve the State's research infrastructure and human resource development through a comprehensive statewide plan for integrating sustainable research, education and workforce development within the framework of WV's universities, PUIs, and CTCs and the State's citizenry.

**Broader Impacts:** This RII will not only advance technology important to national security, but also provide significant research and education experiences for a diverse group of students, post docs, high school teachers and institutions in the state. Research discoveries, education and workforce development programs will enhance the prosperity of the State and the nation by preparing our citizens for the increasingly knowledge-based economy. Existing and developing partnerships with small technology companies, large industry and government agencies such as DoD ensure that discoveries will be applied beneficially to the problems of the state and nation.

## TABLE OF CONTENTS

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For font size and page formatting specifications, see GPG section II.B.2.

	<b>Total No. of Pages</b>	<b>Page No.* (Optional)*</b>
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	3	_____
Table of Contents	1	_____
Project Description (Including Results from Prior NSF Support) (not to exceed 15 pages) <b>(Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)</b>	25	_____
References Cited	7	_____
Biographical Sketches (Not to exceed 2 pages each)	83	_____
Budget (Plus up to 3 pages of budget justification)	41	_____
Current and Pending Support	64	_____
Facilities, Equipment and Other Resources	9	_____
Special Information/Supplementary Documentation	0	_____
Appendix (List below. ) <b>(Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)</b>	_____	_____
Appendix Items:		

\*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.

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## 4.1 STATUS AND OVERVIEW

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WVEPSCoR is driving strategic efforts to build a critical mass of research and innovation capacity that will thrust West Virginia into the mainstream of the world's knowledge economy. Ongoing investments in human and physical infrastructure are enabling WV to transform its once largely extractive economy to a knowledge-driven economy based on advanced science and technology. Central to this goal is a proactive strategy to broaden participation, particularly of underrepresented groups, minorities, and females, in STEM professions. While substantial work remains, strategic investments to date have: 1) stimulated broad-based changes in state and university policies to be more supportive of research, entrepreneurship and diversity; 2) enhanced and strengthened the physical research infrastructure necessary for cutting-edge, competitive research; 3) increased the number, productivity, and diversity of human resources needed to sustain a strong research enterprise; 4) brought scientists and educators together to work collaboratively to increase the effectiveness of STEM education and training; 5) strengthened cyberinfrastructure (CI); and 6) promoted and developed meaningful partnerships among academia, government and the private sector.

The proposed RII plan for FY 2010-2014 builds on existing science and technology (S&T) capabilities. It will enable innovative research, CI, and education and workforce development programs focused on **bionanotechnology for public security and environmental safety**. This interdisciplinary, multi-institutional effort is led by West Virginia University (WVU), Marshall University (MU), and West Virginia State University (WVSU). Also engaged are the state's Predominantly Undergraduate Institutions (PUIs) and community and technical colleges (CTCs). WV's vision is to achieve a nationally recognized and sustainable research and education Center in bionanotechnology that integrates research and education, advances knowledge in science and engineering through innovative approaches and contributes to the economic vitality of the state and the nation.

**State Support for R&D:** In 2004, Governor Manchin called upon universities to build a solid foundation for high-tech infrastructure enhancement and innovation, "anchored by R&D partnerships among universities, government and the private sector." In FY2005, WVEPSCoR led academic and business leaders to produce the state's S&T strategic plan, [Vision 2015](#). The plan names identification sciences and bionanotechnology as two key industries for development. Under the bionanotechnology umbrella, *Vision 2015* directs attention to developing public security and environmental safety technologies. In FY2007 and 2008, Governor Manchin and the Legislature embraced *Vision 2015* and created "Bucks for Jobs," which provided \$140M for research and economic development. *Bucks for Jobs* has 4 components: The first and second, respectively, are the Research Trust Fund (RTF, \$50M with matching totals \$100M) and the Eminent Scholars Recruitment and Enhancement Program (ESRE, \$10M); both are directed at hiring world-class researchers. Under the third component, the Governor created two Advanced Technology Centers (ATC, \$30M) to strengthen the technical workforce. The fourth component includes a consolidated Workforce Development Council and Jobs Investment Trust to conduct assessments and make capital investments in workforce and job creation.

**Academic and R&D Enterprise:** WV's public universities and colleges serve more than 87,000 students, including 9,400 graduate students and 2,200 students in professional programs. More than 3,200 graduate and professional degrees were awarded in 2007. The WV Higher Education Policy Commission (HEPC) is the state agency charged with primary oversight of academic programs, state budgets, student financial aid, policy, and governance of state institutions of higher education. HEPC is also the fiscal agent for WVEPSCoR. Each of our university partners has unique strengths and missions. WVU is a land-grant institution with a medical and pharmacy school and the only institution in WV with Carnegie RU/H: Research Universities (high research activity) rank. The latest Carnegie classifications for MU and WVSU are Master's L: Master's Colleges and Universities (larger programs) and Bac/A&S: Baccalaureate Colleges

-Arts & Sciences, respectively. MU has three doctoral programs - one in biomedical sciences - and a medical school, while WVSU, an HBCU and 1890 Land Grant institution, has an M.S. in biotechnology.

In spite of significant improvements, WV ranked 44th in the nation in **total** academic R&D, with \$170.9M of expenditures in FY2008.<sup>1</sup> In WV, WVU dominates **federal** R&D expenditures and expended \$68.1M of federal R&D funds in FY08; MU expended \$18.5M; and WVSU spent \$2.7M.

**Strengths:** *There is a unified vision and unprecedented state support for research and development. New S&T policies and programs, spearheaded by WVEPSCoR, serve as cornerstones of the state's economic development plan. Effective use of RII support has not only strengthened WVU, MU and WVSU research and STEM education capabilities with people and tools, but it has increased competitiveness for federal and private sector research grants. There is strong leadership and consensus among state leaders that WV must focus its resources on pathways that create economic benefits aligned with Vision 2015, which guides this RII and associated activities. A newly legislated statewide Science and Research Council (SRC) oversees all the state's investments in R&D, including EPSCoR and will focus investments on research opportunities that lead to innovation and economic development. The SRC will help to manage this RII providing state-level leadership and exposure. Core strengths in new faculty, shared facilities and education and outreach projects have developed as a result of sustained investment by the State, institutions and WVEPSCoR. A unique focus on bionanotechnology and biometrics has positioned WV to leverage this RII investment. This focus has also led to increased federal, private-sector funding, and collaborations across the state, the nation and the world.*

**Barriers and Opportunities:** Barriers to research competitiveness include a lack of critical research infrastructure resources, current state of structural, organizational and incentive-related policies, and low total numbers and levels of diversity in the STEM pipeline. Resource allocation is also an issue. WV, like all other states, has had its higher education budgets cut, making recruitment of senior faculty, diversity hires and top quality postdocs and graduate students a challenge. However, we are gaining ground as a consequence of advances made through state and EPSCoR efforts. Specifically, state support and research investments from the WVU and MU Foundations have supported endowed professorships and chairs, doctoral fellowships and scientific research with a strong impact on the economy. *Opportunities* exist to use prior investments so that WV can reach ambitious goals. For example: 1) the vision of a Center in bionanotechnology will occur if a foundation of multidisciplinary, synergistic research activities continue to be established; 2) system level policies are in development to enhance diversity ; 3) education and workforce development programs that include PUIs and CTCs can be created and fully integrated into the work of the Center to engage a broader portion of the state's talent to inspire, motivate and provide rigorous preparation in STEM for students to pursue high technology careers; and 4) recruitment and professional development of K-12 teachers can be improved to provide the tools and knowledge in inquiry-based instruction to enhance the number and preparedness of students in STEM at all levels.

**Goal:** The goal of this RII proposal is to provide the necessary infrastructure to stimulate innovative research and integrated education, workforce development and diversity programs around a platform of bionanotechnology for enhanced public security and environmental safety. Specific objectives are to: 1) increase the human and physical resource base for advancing research capacity in bionanotechnology and cellular mechanisms; and 2) develop and implement education and workforce development programs to educate and train a diverse group of students to succeed in a high-technology-based economy. Success will enhance the competitiveness of WV academic institutions and help transform the economy, creating new employment opportunities in the state.

**Strategy:** The RII program is directed toward a number of complementary activities to enhance the competitive position of WV S&T to the benefit of its citizens. Specific infrastructure investments include:

1. Investing in Interdisciplinary Research Teams (IRTs) through new hires and advanced equipment to design and fabricate the critical components for next-generation devices to exploit opportunities in molecular recognition and cell-based platforms. The IRTs will serve as a model for interdisciplinary efforts across multiple WV institutions and build a cyber-enabled network of scientists and engineers.
2. Seeding new research opportunities in cellular biology. This research investment will help leverage established and ongoing state and federal investments in bionanotechnology, thereby providing tools to explore cells and their environment at the nanometer scale. It will also provide a robust opportunity for student training to state-of-the-art research experiences.
3. Enhancing student and faculty diversity by implementing a system-wide diversity action plan, the core of which is a WVI<sup>3</sup> (Innovation through Institutional Integration) Think Tank charged with bringing together key scientists and educators to direct, integrate, and fill gaps in currently funded K-20 programs.
4. Providing workforce training and development opportunities to a diverse group of students and institutions through a new PUI/CTC Incubator, piloting a business-science M.S. program, and engaging the private-sector through internships and entrepreneurial coursework.
5. Enhancing CI by providing researchers with advanced tools to predict nanoscale behavior. This activity will complement the recent EPSCoR Track II (RII-T2) award, linking human resources in the state to leverage their intellectual capital.
6. Improving science teacher retention and competency through a pilot program, Teacher Research Experience for advancing Knowledge; recruiting teachers through a Learning Assistants program tied to research activities; and providing underrepresented minority, disabled persons, first-generation college students and women the tools to be successful in future careers through a new graduate fellowship program.

Collectively, these initiatives will strengthen the State's human resource base and provide needed tools to create integrated devices that will advance ongoing biometric identification efforts for public security, detect environmental toxins, and explore how cells can be used as a platform for more advanced diagnostic devices with private sector engagement.

**Rationale:** Previous RII and state investment have positioned WV to focus on bionanotechnology as a platform for future R&D. WV's investment in tools and human resources to build a bionanotechnology platform will advance 1) next-generation public security research, supporting state leadership in molecular recognition; 2) field deployable technology to promote environmental stewardship in support of green growth of WV's energy intensive economy; and 3) nanoscale cell-based devices that can be used to explore cellular responses to the environment. The WVNano Initiative, a State-wide organization enabled by the 2006 RII grant, will coordinate the proposed major scientific and educational activities and will be the catalyst for the Center's creation. The current proposed effort will serve as the foundation for a sustainable, externally funded Center of research excellence in bionanotechnology benefiting from the State's established and emerging research and education programs in biometrics, nanotechnology, forensic science, and molecular biology at WVU, MU, and WVSU. Best practices will arise from a careful assessment of the program and through dissemination will help transform other regions of the U.S. competitively moving forward into the future.

#### **4.2 RESULTS FROM RELEVANT PRIOR NSF SUPPORT**

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The goal of the 2006 RII grant (#0554328) was "to identify enabling technologies for achieving viable integrated molecular recognition standard cells through testbed exploration of novel co-integrated molecular recognition and transport functional building blocks." Specific objectives included: 1) organize discovery and innovation around the functional building blocks with which to construct integrated molecular recognition testbed devices; 2) build and bridge crosscutting faculty teams through strategic cluster hires and development of early career faculty and hires of postdoctoral associates at WVU and

MU; 3) build strategic collaborative relationships with national and regional academic and industry partners to bridge capability voids, complement strengths and accelerate targeted research; and 4) enhance, institutionalize, and continually improve WVNano shared facilities and academic environments necessary to promote discovery and learning activities of these groups and institutional initiatives and culture changes these groups have precipitated. The following key results which laid the groundwork for the current proposal were achieved:

**Increased faculty through cluster and targeted hiring.** At WVU, 10 faculty were hired: *Wu* (Mech. Eng., 2006), *Carroll* (Chem., 2006), *Lewis* (Physics, 2007), *Ganikhanov* (Physics, 2007), *Cao* (Elect. Eng., 2007), *Sooter* (Biology, 2008), *Liu* (Elect. Eng., 2009), *Dinu* (Chem. Eng., 2009), *Toth* (Sci. Edu., 2009), and *Simien* (Mech. Eng., Jan. 2010). Faculty hired at MU included *Wang* (Chem., 2007) and *Price* (Biol., 2006). Women and underrepresented minorities were targeted (6 of 12 new faculty hires are women; 1 is an African-American). Faculty diversity goals fostered an interdisciplinary FBBG research culture, and led to a Presidential and Chancellor-level focus on diversity and spousal hiring policies. New hires play important roles in the proposed RII.

**Grew strong, interdisciplinary FBBGs.**

Interdisciplinary functional building block groups (FBBGs) were significantly strengthened (from 6 to 25 faculty total), with expertise being developed in microfluidics, nanokinematics (molecular motors), electronic transduction, and photonics. In addition, 9 collaborative grants, involving at least two EPSCoR-supported FBBG areas, were funded for a total of \$2.7M (e.g., N. Wu, *Correlation among Physicochemical Fate and Toxicity of TiO<sub>2</sub> Nanoparticles*, NSF-CBET, \$300,000, 2008). Six grants were enabled by RII infrastructure for a total of \$3.4M (including two NSF CAREER awards, e.g., M. Shi, *Developing 1,2,3 Triazole Skeletons as Novel Chiral Building Blocks in Asymmetric Catalysis*, \$550K, 2009). Five STEM education grants totaling \$1.3M were awarded, including a NSF Noyce grant. A collaborative grant was awarded to both WVU and MU PIs, and another enabled by the RII was obtained by MU.

**Established regional, national, and international collaborations.** Several collaborations were established between WV and national laboratories and universities – the Advanced Light Source/Lawrence Berkeley Lab.; Stanford Synchrotron Research Lab.; Los Alamos Neutron Science Center; Argonne Natl. Lab.; Natl. Institute of Standards and Technology; Northwestern Univ.; Duquesne Univ.; Natl. Energy and Technology Lab.; Center for Integrated Nanotechnologies/Sandia Natl. Lab.; Oak Ridge Natl. Lab. These interactions enabled characterization and fabrication of biomolecular, magnetic, and photonic devices using national facilities (i.e., nanolithography, synchrotron, TEM, and neutron scattering facilities) as well as collaborations related to energy research. A close relationship has also been established with Protea Biosciences (postdoc, patent application help), a start-up company in Morgantown, WV specializing in biotechnology. Relationships with other companies including Lockheed-Martin, Sagem and Raytheon have also been established. Internationally, a research contract has been established with IC Innova USA/Japan for mutual research and development of wide bandgap semiconductor devices and

**Key Results at a Glance**

- **People:** Hired 12 faculty, six of whom are women and one is African-American. These new hires formed the core of interdisciplinary teams conducting research in molecular biometrics. Involved more than 100 students and postdocs in research annually.
- **Tools:** Operationalized over 5000 ft<sup>2</sup> in new shared facilities, now fully utilized and sustained by an agreement between WVU and HEPC, which provides support from user fees, WVU and the State.
- **Ideas:** Awarded 15 awards, totaling more than \$3.5M, published 77 peer-reviewed articles and filed 7 invention disclosures during FY2009 – a gain of 50 and 6, respectively, over the FY2005 baseline. Also received an industrial research contract (\$1.0M).
- **Research Culture:** Implemented a new dual hire strategy resulting in targeted diversity hires. Promoted multi-institutional, collaborative publications and grants; and secured \$140M in new state investments in R&D.



nanophotonics for solid state lighting. This two-year award in excess of \$1M has enabled efforts of the Photonic FBBG as technologies developed are essential building blocks for many sensor architectures.

**Created sustainable shared facilities.** The 2006 RII resulted in the establishment of the Shared Resource Working Group (SRWG) at WVU and its integration into the WVNano organizational structure. The SRWG supports coordinated and collective operation and management of WVNano equipment resources (Sec. 9). MU and WVSU faculty have used the facility over the past three years. MU and WVSU are also developing shared facilities on their campuses. Day-to-day WVNano Shared Facilities (SF) activities are the responsibility of SF coordinator Kolin Brown, PhD. He is assisted by two technicians who coordinate operations of equipment resources they oversee. The SF has benefited from the research of more than 50 undergraduate students, 30 graduate students, and 5 postdocs during the past three years. These include undergraduate students participating in Summer Undergraduate Research Experiences (SURE), the WVNano NSF REU Site, and undergraduate students trained to use clean room facilities as part of EE 455 (10 students/year) taught at WVU. The proposed new instrumentation infrastructure at WVU will become part of the SF which is supported through a funding formula between users, HEPC and WVU.

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### 4.3 RESEARCH PROGRAM

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Effective real-time, portable identification and environmental sensors are essential for security applications where an individual or pathogen needs to be identified accurately and quickly and for monitoring environmental threats (toxins, heavy metals) remotely in industrial settings. Barriers to development of these sensors include a lack of 1) rapid, field-deployable DNA fingerprinting, 2) miniature ultrasensitive toxin and other environmental hazard sensors that do not rely on large laboratory equipment and 3) knowledge of how to quickly determine damage to cell functionality. To accomplish this, the research will 1) leverage core strengths in bionanotechnology; 2) create necessary research instrumentation and laboratory infrastructure complementary to existing shared facilities; 3) strengthen regional collaborations with leaders in the field; and 4) install scientific computing capabilities to support experimental work. In general, research will be guided by a desire to create tools with real-time readouts and to eventually validate those against existing standards to ensure utility.

Proposed S&E research activities will be organized into Interdisciplinary Research Teams (IRTs). IRTs will include investigators from science, engineering, and health disciplines. IRT 1 (*Portable and Rapid Identification Platforms*) and IRT 2 (*Field-deployable Microfluidic Electrochemical Sensors for Multiplexed Detection of Heavy Metals and Small Molecule Toxins*) will be led by WVU and will engage colleagues from across the state (via PUI/CTC Incubator program) and the region. IRT 3 (*Ex Vivo and In Vitro Biomimetics for Cellular Response Monitoring*) will be led by MU with researchers from MU and WVU.

IRTs include several experts in their fields, and leverage different areas of expertise to create new platforms for integrated devices. IRTs will solve fundamental S&E problems, including interconnects between sensor elements and underlying chip architecture; and integration and manipulation of live cells in a microfluidic chip where they can be monitored and metabolism measured downstream via nanosensors. IRT research will leverage expertise developed during the prior RII (photonic crystals, novel microfluidic separation techniques, bioelectronics, biokinematics), the result, in part, of many young faculty who were engaged in the research effort.

IRTs are organized with leader(s) in charge of the overall effort and smaller working (functional domain) groups focused on specific device components. Group coordinators help drive these smaller work groups, tapping into additional expertise as the project moves forward and challenges are encountered.

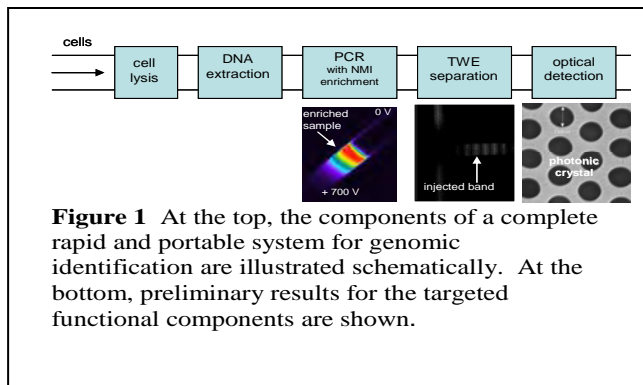
## IRT 1: Portable and Rapid Identification Platforms

IRT Leaders: Timperman, Hornak (WVU); 1 postdoc, 7 graduate students; 3 undergraduates

Functional Domain Group	Group Coordinator	Group Participants
PCR Processes	Lukomski	Sooter, Shi
Traveling Wave Electrophoresis	Carroll	Timperman, Liu, Edwards
Optical Transduction	Dawson	Hornak, Cao, Korakakis

**Background:** Human molecular biometrics based on an individual's unique molecular signature is gaining renewed interest as a means of automated identification. End-to-end processing times of integrated systems have decreased and the potential for combination with rapid automated physiological and behavioral biometrics is being realized. Affiliates of WVU's NSF Center for Identification Technology Research (CITeR) including Department of Homeland Security (DHS), Department of Defense (DoD), Lockheed-Martin, Raytheon and Sagem, have long-term goals of using molecular biometrics for screening at borders or within operational scenarios that require validation of paternity or familial relationships and ultimately for individual identification. IRT 1 targets approaches and component technologies that address key barriers to creating rapid, portable DNA analysis needed for biometric applications.

Lab-based DNA sequencing has revolutionized forensic sciences by providing a highly accurate means of identifying individuals that can be used to corroborate exculpatory characteristics of fingerprint and other crime scene evidence. Molecular biometrics presents challenges in data acquisition and signal processing unique to collecting, isolating and identifying individuals quickly and reliably. DNA and other molecular signatures have not traditionally been considered within the realm of field-deployed biometric technologies due to relatively long end-to-end processing time (~12-36 hrs for conventional lab-based DNA assays, 1-2 hrs in integrated systems<sup>2</sup>) and unique skill sets required to perform these processes. Lab-on-a-chip (LOC) systems with complete sample-in/answer-out capability provide a means of expanding advances in molecular recognition to handheld, portal, or kiosk-based systems that can be used to collect and process DNA or other molecular samples quickly and without extensive scientific training. The analytical power of microfluidic systems for analysis of DNA is well established.<sup>3-5</sup> However, improvements in LOC functional domains of extraction/amplification, separation and optical transduction processes are critically needed to meet requirements for portable devices capable of rapid (<10 min) analyses necessary for human screening applications in typical operational security scenarios. These challenges are the focus of this IRT's efforts.



**Approach:** To enable rapid and portable microfluidic systems capable of identifying humans by DNA fingerprinting, IRT1 will develop three critical components: rapid PCR with nanofluidic/microfluidic interface (NMI) concentrators; rapid DNA separations with traveling wave electrophoresis (TWE) and photonic crystals (PhC) for sensitive and integrated fluorescence detection. A conceptual overview of the integrated system is in Fig. 1, which begins with cell lysis and DNA extraction. After DNA extraction, PCR will be used for

selective amplification of targeted DNA sequences. Amplicons produced by PCR will then be separated by TWE, a novel separation method developed at WVU.<sup>6</sup> The integrated fluorescence transducer will be fabricated to detect PCR products labeled with an intercalating dye, e.g., TO-PRO-3.

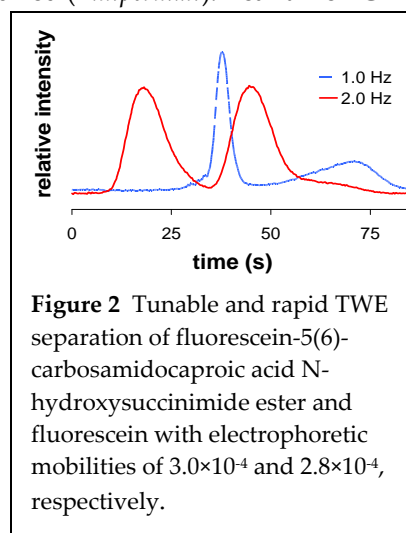
The initial focus will be on development and optimization of novel components that improve individual steps in the overall process. Individual components will be designed and scaled with the goal of seamless integration into a prototype device using the new BRF shared facilities (See 4.3.2). Modeling that utilizes the new CI and focuses on microfluidic (*Edwards*) and optoelectronic performance (*Dawson*) will be critical to design of these components. Testing individual components will be a collective effort across IRT 1 with standards set for resolution and sensitivity. Balance between these parameters will be critical to ensure that the ultimate device will perform up to desired specifications. Initially, performance of the three critical components will be evaluated using amplicons from PCR that will be purified off-device (*Lukomski, Sooter*).

A novel approach for PCR will be developed that improves speed by enriching the plug of DNA at each PCR stage and that uses nano/microfluidic interface (NMI) concentrators.<sup>7-9</sup> NMI concentrators will be used to enrich substrate and product concentration during each stage of thermal cycling to increase PCR speed by shortening cycle time and decreasing number of cycles required (*Timperman*). Real-time PCR will be used to quantitate the DNA as it is amplified.

Separation will be achieved with a novel approach to TWE in a microfluidic channel that uses a sandwich is a free solution electrophoretic separation method that shares similarities with capillary electrophoresis (CE). DNA separation by electrophoresis requires incorporation of a sieving matrix such as a gel or use of drag-tags (*Shi*).<sup>10,11</sup> TWE has the potential to provide higher peak capacities for resolving more amplicons than CE with short-analysis times (< 3-min) using extremely low potential differences of 1 V, simplifying portable systems and eliminating the need for high voltage power supplies required for CE. Additionally, sample enrichment can be performed directly in the separation channel by controlling the local electric field with electrode arrays. TWE separation of two dyes is shown in Fig. 2.

Fluorescence detection systems readily suited for direct integration with microfluidic TWE systems will be developed (*Dawson, Hornak, Cao, Korakakis*) with PhC transducers and optical waveguides developed in parallel. Optical waveguides are needed to deliver light to PhC transducer elements, and provide a useful initial strategy for integrating optical transduction into the microfluidic device. Numerous reports detail integration of waveguide-based transducers into both glass and polymer microfluidic devices.<sup>12,13</sup> PhC-based transducers offer an integrated optical means of routinely performing single molecule detection in LOC systems. However, much research has been focused on developing the transducer rather than transducer and optical source/detector integration. One transducer architecture employs multi-functional nano-opto-fluidic defect regions<sup>14</sup> to enhance fluorescence emission of labeled analyte inside PhC defect cavities via optical confinement and the Purcell effect.<sup>15-17</sup> The IRT's work in this area shows promise for 25-fold or greater fluorescent emission enhancement through spatial confinement of emitted light. Additionally, ultrasensitive detection can be achieved with PhCs by monitoring the red-shift associated with changes in the index of refraction caused by analyte present inside cavity regions of a slab crystal lattice,<sup>18,19</sup> PhC waveguide,<sup>20</sup> or inside PhC defects.<sup>21,22</sup> Optical transducers will be assembled into a hybrid optofluidic testbed to determine the optimal detection limit for fluorophore-labeled PCR amplicons generated in the prior component.

IRT research will provide novel technologies for integrated LOC molecular biometrics systems and processes. Additionally, these new technologies can be used in prevention and investigation of terror attacks, for diagnosis of human infections, and for protection of troops in biological warfare. The work defines the design and fabrication framework from which a family of devices can emerge for proteomic



and genomic analysis as new discovery yields improved building blocks for component functions. Challenges exist in the design and behavior of various elements as a matter of scale. Modeling will ease these challenges and allow microfluidic behavior to be predicted and effectively used. Close integration of this IRT will ensure that each component is designed, fabricated and tested to be consistent with the overall device concept. Private-sector and other partners will be encouraged to participate in the research dialogue to ensure that advances made by IRT 1 are compatible and transferable to end users.

## **IRT 2: Field-deployable Microfluidic Electrochemical Sensors for Multiplexed Detection of Heavy Metals and Small Molecule Toxins**

*IRT Leaders:* Wu & Gannett (WVU); 1 postdoc, 7 graduate students; 3 undergraduates

<i>Functional Domain Group</i>	<i>Group Coordinator</i>	<i>Group Participants</i>
Aptamer Selection and Binding	Sooter	Holland, Gannett
Microfluidic & Device Integration	Liu	Famouri, Dinu, Wu
Theory	Lewis	Gannett

**Background:** WV's economy is driven by coal, metal manufacturing, agriculture and forest production. Heavy metals are released from coal mining and coal-fired power plants; pesticides and herbicides enter the environment from agriculture, forest and household activities. The World Health Organization has set allowable levels of Hg, Pb and As in drinking water at 6µg/L (6 ppb), 10µg/L and 10µg/L, respectively, and set a maximum allowable limit for pesticides in ground water at ~0.1µg/L. Measurement of such low levels of toxins currently requires lab-based analytical techniques such as inductively coupled plasma-mass spectrometry for heavy metals<sup>23,24</sup> and mass spectrometry for pesticides.<sup>25-27</sup> These techniques are expensive, labor-intensive, time-consuming, require relatively large sample volumes and are not field-deployable. There is a strong incentive to develop reliable, cost-effective and field-deployable sensors for measuring heavy metals and small molecule toxins in the environment. Heavy metal sensors in development include spectroscopic/colorimetric sensors,<sup>28-30</sup> biosensors,<sup>31-33</sup> and oligodeoxyribonucleotide (ODN) based sensing systems.<sup>34,35</sup> Pesticide/herbicides are typically detected by enzyme electrodes<sup>36</sup> or by immuno-assays using antibodies as molecular recognition probes.<sup>37</sup> Many attempts have been made to develop portable sensors for heavy metals and small molecule toxins, but a growing societal need for high-performance sensors remains unmet due to an inability to achieve adequate selectivity, sensitivity, reliability, response and portability.

**Approach:** The goal is to develop the fundamental scientific knowledge and engineering approaches required to eventually fabricate a highly sensitive, selective, and portable field-deployable microfluidic electrochemical sensor of heavy metals (Hg, Pb and As) and pesticides/herbicides (malathion, atrazine, propanil). This sensor would eventually achieve detection and analysis time comparable or better than commercial large-scale analytical instruments. The IRT's approach will leverage a sensor element and signal transduction device, developed by *Wu* and co-workers at WVU that are sensitive and analyte specific. Modeling that takes advantage of CI investments (*Lewis, Gannett*) will be critical as the subsequent design/fabrication/testing cycles will limit the number of iterations possible. Access to advanced existing and BRF shared facilities fabrication tools will allow these devices to be created, characterized and tested in a single laboratory environment, thus minimizing spurious effects and increasing reproducibility.

It is difficult for a macroelectrode to detect ultra-low concentration of molecules due to small signal and large background current associated with stray capacitance and impurities.<sup>38</sup> By reducing electrode size to less than 100 nm, enhanced mass transport, increased temporal resolution, reduced effect of solution resistance, improved signal-to-noise ratio and lowered detection limits are possible.<sup>39</sup> The IRT proposes to develop nanoelectrode arrays (NEAs) as the working electrode to increase signal-to-noise ratios with respect to a single nanoelectrode.<sup>40</sup> For a low-density NEA with large inter-electrode spacing, diffusion

profiles surrounding individual electrodes are independent. Such an NEA shows a sigmoid-shaped voltammogram with high maximum current density and signal-to-noise ratio (high density NEA leads to low-current peak-shaped voltammogram).<sup>41</sup> However, even a high-density NEA has a much higher signal-to-noise ratio than macroelectrodes because Faradaic current (signal) depends on geometric area ( $A_{geo}$ ) while capacitive current (background level) depends on total active electrode area ( $A_{act}$ ).<sup>42</sup> For NEA hemispherical electrodes (radius=50 nm, spacing=1  $\mu$ m),  $A_{geo}/A_{act} \sim 3200$  which will lead to a detection limit three orders of magnitude lower than macroelectrode counterparts.

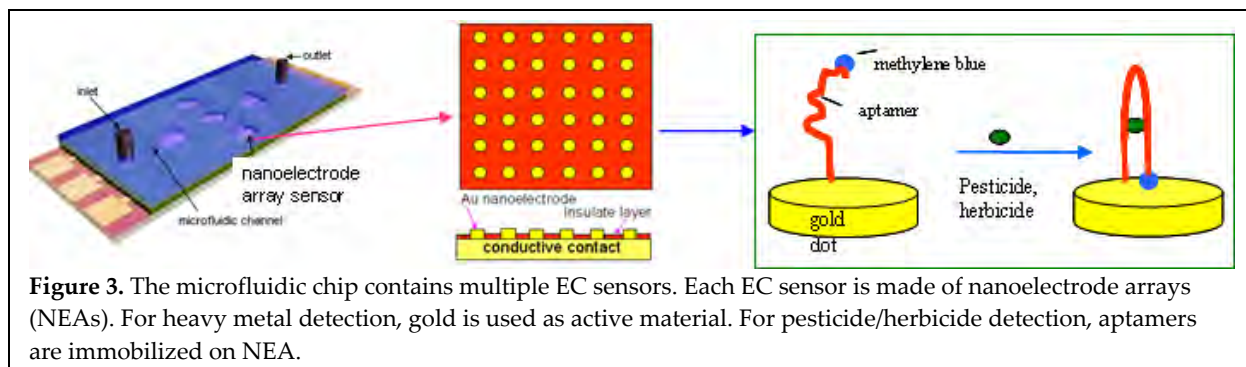
Application of NEAs and fundamental studies of electron transfer and mass transport in NEAs have been impeded by lack of an effective approach for NEA fabrication. IRT 2 will fabricate large-area NEAs via nanosphere lithography with controlled pitch and size and investigate mass transport and electron transfer at the NEAs ( $Wu$ ). For a hemispherical electrode, mass transfer coefficient is given by  $D/R_o$  ( $D$  = diffusion coefficient), so that for large electrodes, mass transport is the rate-limiting step.<sup>43</sup> The team will investigate how electrode size and pitch affect mass transport and electron transfer processes.

Nanosphere lithography is a robust and facile fabrication approach that allows precise nanoscale features to be created over large areas. Devices fabricated using nanosphere lithography will be characterized and tested to achieve levels of sensitivity consistent with current bench-top analytical instruments.

For detection of heavy metals, gold will be used as the active material for nanoelectrodes. Au and SiO<sub>2</sub> areas are functionalized with a self-assembled 3-mercapto-1-propanol and polyethylene glycol layer, respectively. IRT 2 has experience in surface functionalization<sup>44,45</sup> and does not anticipate difficulty in surface modification. The square wave anodic voltammetric stripping method will be used to analyze various concentrations (0.1-200  $\mu$ g/L) of  $M^{n+}$  ( $M^{n+}$ = Hg<sup>2+</sup>, As<sup>3+</sup> and Pb<sup>2+</sup>) electrolyte solution (10 mM HNO<sub>3</sub>+ 0.1 M NaCl). "Finger-print" stripping potential will be used to distinguish heavy metals. The sensor will be tested with aqueous samples containing Hg<sup>2+</sup>, As<sup>3+</sup> and Pb<sup>2+</sup> at various concentrations and water samples from local sources. Heavy metal detection can be accomplished using selective electrical treatments to achieve specificity. However to extend NEA technology to other analytes, a sensor element needs to be integrated that imparts specificity for the target analyte. For pesticide/herbicide detection (malathion, atrazine, propanil), aptamers, short pieces of nucleic acid that change conformation when binding to a specific molecule,<sup>46-47</sup> will be developed as the molecular recognition element.

As a starting point, signaling aptamers can be selected through a systematic evolution of ligands by exponential enrichment (SELEX) which bind to a specific molecular target (e.g., atrazine) (Sooter, Holland). The SELEX method can benefit by a computational component to limit initial diversity of the aptamer pool screened against a specific target. The software package eHiTS<sup>48</sup> will be used to predict binding of small molecules to oligonucleotides and relative contributions of the motifs involved in binding. NMR structure determination of SELEX-identified aptamer-analyte complex will be used to develop the initial eHiTS model. This model will be used to screen the ZINC database (ZINC contains ~75,000 compounds, all commercially available) for other molecules that may bind to the aptamer. The binding model with these potential target analytes will be verified experimentally (binding constants and structure determined via NMR) and resulting data will aid in model refinement.

Aptamers that bind analytes through minor or major groove interactions will be rejected since no significant conformational changes are predicted to occur upon analyte target binding. Aptamers that bind analytes by interchelation into the helix through two or more base-substrate binding interactions will serve as the basis for the eHiTS model and will be re-engineered into a single strand so the same binding interactions occur and produce the desired conformational change (Gannett).<sup>49</sup> For example, a hairpin motif will be used for aptamers found to utilize two bases for binding (Fig. 3).<sup>50</sup> Re-engineering will be based on the partial-disassembly approach and requires (i) molecular modeling methods (for example, a density-functional theory code called FIREBALL (developed by Lewis) to elucidate key



**Figure 3.** The microfluidic chip contains multiple EC sensors. Each EC sensor is made of nanoelectrode arrays (NEAs). For heavy metal detection, gold is used as active material. For pesticide/herbicide detection, aptamers are immobilized on NEA.

binding interactions and determine presence in the re-engineered aptamer (Gannett, Lewis) and (ii) synthesis of new aptamer and NMR study to confirm binding mode and conformational change (Gannett).<sup>51,52</sup> Aptamers will be thiol-terminated on the 5'-end so they can be readily immobilized on the Au NEA. Methylene Blue (MB) linked to the 3'-end of the aptamer will serve as an electrochemical redox indicator and is reduced at a known potential to leucomethylene when near or at the electrode surface.<sup>53,54</sup> When the target analyte is present in solution, the analyte will bind to the aptamer producing a conformational change to bring MB close to the working electrode (Fig. 3 inset). Enhanced electron transfer will result between electrode and MB, producing a concentration-dependent Faradaic current. For both heavy metal and pesticide sensor platforms, the system will be composed of a microfluidic electrochemical sensor, a commercial handheld potentiostat analyzer and a battery-powered palm-sized controller or laptop computer. Multiple electrochemical sensors (Wu) will be integrated into a single microfluidic chip (Liu) to realize multiplexed detection requiring only a small amount of sample. Each electrochemical sensor will contain a counter electrode (Pt), reference electrode and working electrode made of a gold NEA<sup>55</sup> in which gold dots are separated by an insulating SiO<sub>2</sub> layer.

### IRT 3: *Ex Vivo* and *In Vitro* Biomimetics for Cellular Response Monitoring

IRT Leaders: Price (MU), Rojanasakul (WVU); 2 post docs, 12 graduate students, 6 undergraduates

Functional Domain Group	Group Coordinator	Group Participants
Microfluidic design	Wang	Norton, Timperman, Liu
Cellular capture/function	Price	Rojanasakul, Li, Dinu
Optical characterization	Ganikhanov	Blough Norton, Famouri
Integrated nanosensor	Wu	Norton, Rojanasakul

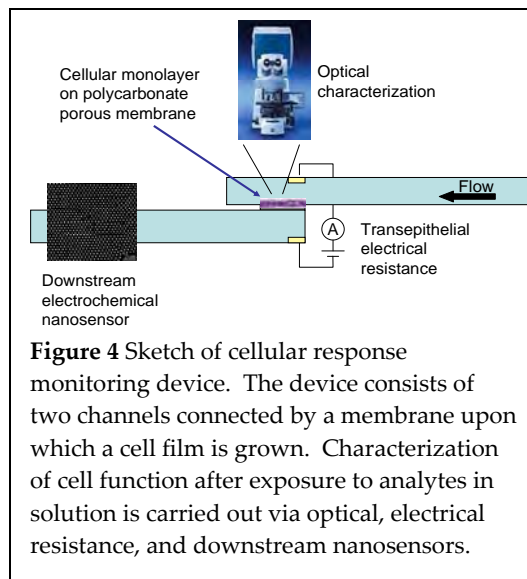
**Background:** The goal of IRT 3 is to develop groundwork for a cell-based sensor platform that seeks to replicate the complexity of cell behavior in a chip-based component. These cell-based sensors will advance analytical investigations beyond composition to determine fundamental effects of materials in the environment. To achieve these goals, microfluidic technology that supports *in vitro* (from cultured cells) and *ex vivo* (from fresh biopsies) culture will be developed and combined with optical microscopy and downstream integrated nanosensors for analysis of cells that naturally grow *in vivo* as monolayers. Most mammalian cells rarely function as isolated individual cells and this is especially true for respiratory epithelial cells and vascular endothelial cells, which grow and function as an interactive monolayer of cells. Cell-based microfluidic devices that separate monolayers into individual cells most likely disrupt functions that require cell-cell interactions, rendering them less than ideal as models for behavior of organs and responses to external agents. IRT 3 focuses on both epithelium and endothelium monolayers that simulate artificial tissue, chosen for their barrier, transport and “first responder” role in the airways and vasculature, respectively. Drugs, toxins, pollutants and other deleterious agents must

first pass through these defenses and it is logical to develop tools that exploit these very cells as sensors. IRT3 Leaders (*Price, Rojanasakul*) have expertise with both cell culture types.<sup>56-62</sup>

**Approach:** IRT 3 will explore development of a cell-based platform that will allow real-time inquiry of physiological responses to external agents. The underlying premise is that monolayers of cells more closely resemble the physiological function of epithelium and endothelium compared to dissociated cells. As a result, it should be possible to determine the effects of toxic agents on cell physiology. To exploit cellular responses integrated with microfluidic devices, 1) optimal cell growth and capture methods in microfluidic devices with porous interfaces will be developed; 2) cells will be exposed to physiological fluid flow conditions and 3) optical and downstream integrated sensor signals will be analyzed to determine cell viability and functionality when exposed to toxins.

The proposed device is sketched in Fig. 4. Fabrication will be facilitated by investment in tools made of materials compatible with individual biological molecules and cells. These tools can use non-silicon materials, including polymers and biomaterials. Use of these materials ensures the interface between device and biological component (i.e., cell populations) will be compatible. Electrodes and optical interrogators will be introduced using a design-fabrication approach that involves contributions and collaborations between life scientists and engineers. New cyberinfrastructure will not only help model flow in cell-covered channels, but investment in the communication network and digital tools for promoting collaboration will be of enormous benefit to this geographically distributed effort. Fabrication of basic microfluidic polydimethylsiloxane (PDMS) circuits will be performed in collaborative efforts between *Norton and Wang* at MU and *Timperman* at WVU. Among the challenges are incorporation of electrical sensors for tight junction barrier measurements, optimization of antibody or immobilized cellular “traps” and biomimetic modification in the proximal end of the microfluidic device (*Price, Rojanasakul, Timperman* (WVU), and *Li* (WVU)). *Blough, Price* (MU), *Famouri* and *Ganikhanov* (WVU) will collaboratively develop optical detection systems while *Wu* and *Rojanasakul* will develop nanosensors for target indicators, especially NO.

Similar to studies by *Rojanasakul's* group<sup>60-62</sup> primary and continuous cultures of lung epithelial cells will be grown on a polycarbonate microporous membrane integrated with a microfluidic device to promote formation of a tight junction monolayer, characteristic of lung epithelial membrane *in vivo* while at the same time enabling transepithelial electrical resistance measurements for cell function assessment. The polymer membrane will be incorporated into the microfluidic device using existing expertise in fabricating nano/microfluidic interfaces fabrication techniques (*Timperman*) using PDMS channels.<sup>7-9</sup> Similarly, vascular endothelial cells will be grown on a Matrigel®-coated channel to allow capillary formation, resembling the angiogenic or neovascularization process *in vivo*. Modeling medium flow through these microfluidic devices will be conducted to ensure that parameters such as mixing and shear stress are considered in placement of substrates used to promote cell adhesion and growth. Tight junction permeability of epithelial cells will be assessed by measuring transepithelial electrical resistance via integrated electrical microelectrodes, while capillary formation of endothelial cells will be examined using a classical microscopic tube formation assay. These methodologies are based on established techniques but application in integrated microfluidic device is novel. Device design and approaches will be tested by exposing cells to known toxic agents such as cholera or diphtheria toxins.



General functions such as cell life and death can be assessed by viability assay using calcein AM, apoptosis and necrosis assays such as Hoechst 33342 and propidium iodide<sup>63,64</sup> injected into the microfluidic channel. Since these probes exhibit distinct fluorescence properties, they can be simultaneously detected in the same cell sample by fluorescence microscopy and quantified by imaging densitometry. State-of-the-art optical spectroscopy using laser-excited fluorescence method (both one- and two-photon) for cell characterization<sup>65,66</sup> as well as monitoring of protein and DNA redistribution in apoptotic cells using coherent anti-stokes Raman scattering (CARS) also will be performed<sup>67</sup> (*Ganikhanov*). These techniques probe functionality at the molecular level complementary to macroscopic probes (i.e., fluorescence and transepithelial electrical resistance). As the device is moved toward field portability, integration of fiber optics to direct excitation light from LEDs which collect and analyze the emission using small CCD cameras is feasible. The device will evolve through a series of iterations from benchtop to field-deployment and taking advantage of advances in optical, fluidic and electronic miniaturization. The device will allow studies of cellular function and biological response under more physiologically relevant conditions, i.e., under constant shear force caused by biological fluid or blood flow. Both *in vivo* and *in vitro*, healthy endothelial cells respond linearly to increases in shear stress (flow) by increasing production of NO.<sup>68,69</sup> Media flow over the cultured monolayer will be controlled to deliver increased levels of shear, and NO produced will be assessed using an electrochemical sensor integrated downstream of cells in the microfluidic device (Fig. 4).

An exciting application of such a hand-held device is its potential use to isolate, culture and assay cells obtained from direct biopsy of tissue.<sup>70</sup> In Years 3-5, IRT 3 will study specific antibodies to capture certain cells from biopsies. Antibodies specific for cell markers will be used to trap cells from a mixed population.<sup>71</sup> A microfluidic device can also be used to identify single cells in a complex population based on cell interaction with specific immobilized molecules such as antibodies or extracellular matrix proteins. Endothelial cells express unique CD31 receptors and antibodies are commercially available, providing a facile means of cell capture. Likewise, epithelial cells can be captured by epithelial-specific cytokeratin antibodies.<sup>72</sup> Similar studies have been performed using antibodies to trap cancer cells derived from metastasizing tumors.<sup>73</sup> This will pave the way for a device that uses the function of the trapped *ex vivo* monolayer as a cell-based sensor for environmental disruptors.

#### **4.3.1 Enhanced Strength and Impact through Regional Research Partnerships**

Outcomes of research efforts will be leveraged by partnerships with regional centers of excellence and private-sector organizations. They will provide valuable translational paths for the technology in environmental protection, homeland security and biomedicine. These centers of excellence and collaborators are described below.

**CITeR** is an NSF Industry/University Cooperative Research Center. Its mission to advance identification technology is strongly focused on biometric systems and credibility assessment. CITeR achieves its mission through cross-cutting research of emerging enabling technologies, interdisciplinary training of scientists and engineers, and facilitation of technology transfer to private and government sectors through its affiliates. WVU is the Center's founder and lead site, focusing on biometrics and related identification technology and systems; the University of Arizona is the Center's second site focusing on credibility assessment systems. CITeR is engaged with this proposal (*Hornak*, CITeR co-director) due to strong interest of CITeR's industry partners in new identification platforms. The proposed research (especially IRT 1) will provide a potential detection platform that CITeR needs for its applied technology. **NIOSH** is interested in detection of heavy metals and toxins and in determining effects of nanoparticles on cellular activity. Dr. *Vince Castranova*, an internationally-recognized leader in nanotoxicology at NIOSH, has collaborated with Dr. *Wu* through a recent NSF grant. NIOSH is especially interested in detection of small quantities of toxins (IRT 2) and their effects on cell functionality (IRT 3) to link results to clinical studies at NIOSH. **NIST** is interested in using cell-based systems to determine potential toxicity



of nanoparticles potentially used in industry. Dr. *Debra Kaiser*, Chief of the NIST Ceramics Division in Gaithersburg, MD has agreed to provide standard nanoparticles such as gold (already available) or silver (in development) to use in testbed devices for IRT 3 activities. CEINT at Carnegie Mellon University, led by Dr. *Gregory Lowry*, is also interested in nanoparticle toxicity, in particular, effects of organic coatings. CEINT will provide IRT 3 with standard nanoparticles with different organic coatings to probe toxicity at the cellular level. Knowledge of the effect of these nanoparticles on cell function is of fundamental interest to CEINT. MBRCC's basic research activities focus on the molecular basis of cancer. WVNano has a strong link with MBRCC through members part of both organizations (*Gannett, Rojanasakul, Timperman*) and through research activities designed to detect cancer at early stages using novel biosensors (*Holland, Gannett, Lederman*). MBRCC is interested in studying and identifying cancer-causing mechanisms at the molecular and cellular level. They are especially interested in IRT2 (determining presence of minute quantities of carcinogens) and IRT 3 (which may be able to determine whether nanoparticles are carcinogenic) activities. Protea Biosciences has strong ties with *Timperman* and will continue to provide support to develop microfluidic devices. Protea has provided support to *Gannett, Holland* and *Lederman*.

#### 4.3.2 Proposed New Infrastructure

Investments in instrumentation will enhance long-term competitiveness in WV research. The RII will provide academic institutions, affiliated government and private-sector partners access to equipment for research and staff training. In addition to requested instrumentation, WVEPSCoR is requesting partial support for two junior faculty hires at MU and one at WVSU to help build critical mass for the emerging effort in molecular and cellular mechanisms and a permanent WVNano Director (senior faculty) at WVU.

**Bioengineering Research Facilities (BRF):** Current and proposed research efforts in bionanotechnology are hampered by lack of solid-state electronic and microfluidic device fabrication and characterization tools in conjunction with biological and biomolecular lab facilities and instrumentation. RII investment in the BRF will address this problem. The main facility, on the WVU College of Arts and Sciences campus, will permit bottom-up directed surface immobilization of native and modified biomolecules including antibodies, enzymes and receptors and house facilities for cell culture. The BRF will integrate the ability to functionalize surfaces compatible with biomolecules with nano/microfluidic fabrication to produce biosensors. A satellite facility will supplement the existing shared top-down fabrication facility by providing biological capabilities to the adjacent clean room facilities in Engineering. The lab will be outfitted with standard preparative scale protein purification tools and will be able to sustain cells in culture. All IRTs will make extensive use of these facilities, and will engage approximately 20 undergraduate students, 40 graduate students and 12 postdocs per academic year. Undergraduate students will be greater in the summer (~30) as a result of existing REU and SURE programs coupled to IRT research. PUI and TREK participants will also use the facilities.

**Genomic and Cell Biology Facility:** Two core facilities at MU and WVSU will provide state-of-the-art instrumentation for genomics and cell biology. Equipment will be installed at both institutions to encourage collaboration. These facilities will be useful for IRT 3, MU and WVSU emerging research and will provide support for workforce development and training programs (Sec. 4.5 and 4.7).

**Cyberinfrastructure:** IRT activities will require sustainable computational capabilities to validate and predict electronic properties of biomolecular recognition elements bound to solid state devices (IRT2, IRT 3), model flow in three-dimensional microfluidic structures (with adhered or trapped cells – IRT3) using the TWE approach and nano/microfluidic interfaces (IRT1) and calculate the optical properties of complex photonic crystals (IRT1). Intercampus communication is crucial to maintaining collaborations and efforts to engage scientists across the state in RII research activities. WVEPSCoR proposes purchase and installation of 512 cores to enhance HPC capabilities for this work. See Sec. 4.6 for further details.

#### 4.4 DIVERSITY PLAN

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This RII dedicates more than \$2.6M in new funding to WVSU, a historically black university, to more fully integrate this institution into the research program. Other PUIs, including Bluefield State College, WV's only other HBCU, will be provided competitive support for seed projects to faculty and student programs. (See PUI/CTC Incubator, Sections 4.5 and 4.7)

In 2008, 523 minorities were pursuing STEM degrees at partner institutions. However, retention rates for these students are significantly less than majority students.<sup>74</sup> According to 2006 findings from CEOs for Cities, each additional percentage point improvement in aggregate adult four-year college attainment is associated with a \$763 increase in annual per capita income.<sup>75</sup> To build a diversified and strong workforce, two significant barriers to successful retention must be addressed: 1) matriculation from CTCs and PUIs to partner institutions and 2) student retention of underrepresented populations within partner institutions. An effort focused on achieving the same completion rates as majority students would more than *double the number of minority students receiving STEM degrees* at partner institutions.

**Strategies to Meet Objectives:** WVEPSCoR's diversity plan is initially designed to address student retention issues of underrepresented populations in the STEM enterprise. As WV is an unusually ethnically homogenous state (< 5% minority), its underrepresented populations (UREP) include minorities, women, persons with disabilities, first-generation and/or economically disadvantaged students. WVEPSCoR has established working relationships with state leaders and key diversity recruitment and retention programs on partner campuses including CTCs. Through an ongoing team approach, diversity strategies and initiatives will be conducted, supported and evaluated throughout the project to ensure use of best practices and that benchmarks and milestones are met (Sec. 4.8). Critical to success is support for improvement in UREP student retention at the highest administrative levels, inclusion of retention goals in strategic plans and annual work plans, and accountability mechanisms for achieving goals. UREP student retention will serve as the keystone of diversity initiatives. Anchoring this plan is implementation of a system-wide diversity development strategy. Representative milestones and metrics are in Section 4.8; A formal Evaluation Plan after award will include complete criteria.

***Implement a System-wide Diversity Development Action Plan.*** Following WV's successful NSF-sponsored workshop<sup>76</sup> on "Increasing Diversity in Higher Education," Chancellor Brian Noland announced the HEPC Diversity Initiative in 2009, modeled after other successful, system-wide diversity initiatives.<sup>77-79</sup> The Initiative aims to set goals for developing and supporting enhanced strategies for diversity in all HEPC institutions. This initiative is the basis for long-term STEM-specific activities of WVEPSCoR and related research and education programs. A broad-based Diversity Commission will be appointed to begin a system-wide dialogue to directly address the WV vision for a comprehensive diversity plan that targets UREP student retention (among other targets) at all state institutions. The Commission will create a report of system-wide recommendations as a result of gathered knowledge on UREP student retention. The Commission will target four areas: 1) current gaps within pipeline programs, providing recommendations for programs and activities that increase inclusion and success of UREP students, faculty, and staff; 2) UREP student retention strategies based on exemplary programs, initiatives and partnerships identified by the WVI's "Think Tank" (below); 3) incentives to enhance assessed opportunities for students, faculty, staff, and institutions; and 4) system and institutional improvement strategies. **The Chancellor has initially dedicated \$0.5M in state funding to diversity policy development under this plan.**

***Increase Access:*** Recognizing that cost and access are two significant barriers, the State will continue to fund the PROMISE scholarship program. PROMISE provides \$43 million to 9,300 students who maintain a B average in high school and achieve an ACT score of 22 to attend any higher education institution in the State tuition-free. WV makes another \$40 million available to 9,000 financially disadvantaged students

through the WV Higher Education Grants (HEG) program. The HEG currently supports more underrepresented minority student STEM majors (7.7%) than the overall percent of those minorities in the State. In addition, 12% of HEGs are given to women pursuing STEM degrees.<sup>80</sup> Approximately 63% of the 18,300 scholarships are awarded to first generation college students. PROMISE and HEG scholarship recipients represent 21% of the 87,000 WV college students. Although PROMISE and HEG programs are not specifically focused on STEM, WVEPSCoR will use outreach activities to increase college awareness and enlarge the pool of college-bound UREP and STEM students. These scholarships have moved WV from 49<sup>th</sup> to 5<sup>th</sup> in the nation in need-based scholarships, making increased access a driver of future STEM enrollments. Furthermore, the number of students majoring in STEM fields in WV increased by 18% between 2003 and 2007.<sup>81</sup> Although WV has demonstrated strong commitment to increasing student access, UREP student retention remains troublingly problematic. Therefore, considerable intellectual capacity (Diversity Commission and WVI<sup>3</sup> Think Tank) will target student retention so that WV can capitalize on its significant commitment to enhance college access.

***Strengthen Articulations between CTCs and Universities:*** To ease transition of CTC STEM students to 4-year universities, the PI will work with the Chancellor for CTCs to develop and strengthen existing articulation agreements with PUIs and WVU, MU, and WVSU. The WV effort to engage CTCs is consistent with President Obama's American Graduation Initiative that calls for states to build stronger skills through community colleges. The effort will be further enhanced by active participation of elements of the WVI<sup>3</sup> Think Tank (See below). WVEPSCoR will facilitate achievement measures of the articulation agreements for the Diversity Commission.

***Leverage Innovation for Retention Initiatives:*** WV will capitalize on current programs that broaden UREP participation in STEM. They include: Undergraduate Bridge (WVU, WVSU); the Summer Undergraduate Research Experience (WVU, MU, WLSU, WVUIT, and WVSU); LSAMP (WVU, MU, WVSU, CTC); Underrepresented Research Scholar Program (DSR/institutions); ADVANCE (MU); Summer LAUNCH (WVU); SREB Minority Doctoral Scholars (WVU), and COMmunities Educating Tomorrow's Scientists (COMETS) (MU, WVSU, K-16 schools), among others. These programs provide everything from early outreach activities to minority recruitment for doctoral programs, and from summer bridge programs and academic support services to research experiences. Not only will these programs – which reach more than 1000 UREP STEM students each year – be continued with state and institutional funding, but WVEPSCoR will also integrate these important and competitive programs. **Specifically, WVEPSCoR will bring together a WVI<sup>3</sup> "Think Tank"** with key scientists and educators directing STEM PK-20 education programs to forge a network of productive STEM leaders, report to the Diversity Commission, identify best practices and publish a report of their recommendations. WVI<sup>3</sup> will 1) collect data on barriers, gaps, and solutions for successes, 2) form campus networks and a Statewide network to foster communication across and among campuses as well as form alliances with vested communities and industry; 3) provide increased opportunities for UREP STEM students and use the power of networks to inspire and recruit additional students into STEM pathways; 4) engage PUIs and CTCs to serve as catalysts for integrating best practices and evidenced-based strategies, and 5) catalyze new ideas and funding opportunities to meet the needs of a greater number of students and teachers. *Cartwright* will lead WVI<sup>3</sup> and report to PI Hill.

#### 4.5 WORKFORCE DEVELOPMENT PLAN

Through this RII, WVEPSCoR is complementing the Governor's investments in workforce development (WFD) by focusing on building a diverse workforce in STEM fields, specifically in bionanoscience and biotechnology. WV's objective is to increase technically competent graduates from the state's colleges, universities and community colleges through the following strategies. Representative milestones and metrics are in Section 4.8. A formal Evaluation Plan after award will include complete criteria.

**Strategies to Meet Objectives.** WVEPSCoR will serve as a catalyst to bring together key stakeholders from industry, government and all levels of education, to develop a state-wide STEM workforce development plan that complements and integrates HEPC's Diversity Initiative, as described above. The plan will assess current and future needs and skills required of WV citizens to create new businesses and participate fully in the innovation economy, particularly in nano and bio areas. WVEPSCoR will provide planning funds to launch this initiative. The goal is to create a "workforce development plan" for educational providers, in concert with industry and state government; a plan equivalent to *Vision 2015* which has transformed the academic R&D landscape in WV.

**Workforce Development Training Database:** WVEPSCoR will inventory the current state of workforce training in WV and work to integrate a number of programs already in place. Preliminary steps to help focus future resource allocation are to: 1) conduct research on exemplary state-based STEM workforce development plans (e.g. Virginia, Michigan) and meet with officials of these groups; and 2) create a Governor's WFD Task Force subcommittee specific to academic STEM programs.

**TREK** (Teacher Research Experience for advancing Knowledge): WVEPSCoR will pilot a STEM research/education program for K-12 educators. Recruiting, preparing and retaining prepared K-12 teachers are essential aspects of workforce development because a STEM-literate workforce begins in the K-12 system. Through the proposed TREK program (Sec. 4.9.2), Noyce Scholars and other pre-service and in-service teachers and students will participate in research experiences with active scientists. K-12 teachers and students will engage in peer coaching and mentoring, collaborative learning, and curriculum enhancement — activities that, when integrated, have demonstrated successful professional development outcomes.<sup>82-84</sup>

**PROMISE and HEG Scholarships:** WV will continue its PROMISE and HEG scholarship programs to demonstrate its commitment to an educated workforce. By dovetailing new workforce initiatives with ongoing support of PROMISE and HEG programs, WV will enhance production of STEM scientists, researchers and technicians.

**PUI Incubator Program:** Research collaborations with PUIs and CTCs in WV will be initiated and maintained (See Sec. 4.7). The incubator program will provide seed funds to four promising PUI and CTC faculty on a merit basis. The long-term goal of this program is to grow and sustain statewide research collaborations between the PUIs/CTCs and WV's research institutions through extramural research and education grants. The near-term goal is to enhance student training and experiences in nano- and biotechnology at these institutions to build the workforce in these developing fields.

**MS/Business Degree:** WVSU and MU will partner to provide 15 graduate students in the environmental/biotechnology emerging theme area an academic track option for business along with their M.S. degree. This option will add business and entrepreneurial coursework to cellular biology and environmental/biotechnology programs. Faculty from MU and WVSU will serve on thesis committees of students from both institutions to increase collaborative opportunities for students and stimulate faculty interactions. Students who complete this program will have a sound science background with knowledge of business applications and entrepreneurial strategies. This pilot program will be evaluated and potentially expanded to an MS/MBA degree program.

**Summer Institutes for HPC:** The Shared Computational Facility at WVU will be an educational resource center for all researchers in WV, including PUIs (see Sec.4.6). In addition to HPC training opportunities offered by the RII-T2, 10 PUI faculty and 10 of their students will be mentored by WVU, MU and WVSU computational faculty so they can perform advanced computational science research and collaborate with both computational and experimental faculty in the IRTs.

**Graduate Fellowship Program.** Graduate Fellowships (GF), directed by *Holland*, will address recruitment of a diverse population of highly qualified graduate students to research programs. Each year, cohorts of

six UREP students (24 total grad students during RII award) will receive two-year fellowship stipends for research in bionanotechnology. Fellows will receive training in ethics, interdisciplinary research, technical communication, professional conduct, real world problem solving, cross cultural team building<sup>85-86</sup>, leading to a Ph.D. in a STEM discipline. Students will be mentored by RII faculty and will enroll in a graduate course (*Gannett*) in proposal writing and scientific presentation strategies. They will visit national Centers and learn to network beyond WV including participating in international research internships. Students will complete business coursework and engage in short business internships with regional companies, e.g., Protea Biosciences, WV High Technology Consortium and CITEr partners.

#### 4.6 CYBERINFRASTRUCTURE PLAN

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**Background.** CI efforts will support both broad CI goals and specific objectives of *Vision 2015* which encourages deployment of sustainable resources and expansion of advanced network infrastructure, enhanced HPC and data storage resources, acquisition of inter-institutional collaboration tools, and development of advanced applications and tools for the research community. These efforts also support linkages from the research community to other WV and Federal initiatives. In 2008, the WV Legislature established the Broadband Deployment Council to guide commodity broadband deployment to unserved and underserved areas of WV. Federal efforts (2009 ARRA) have placed significant emphasis on broadband deployment. CI-related activities described below will help drive broadband demand in, and at the same time address the needs of, WV's research and education communities.

The current CI landscape shows progress toward *Vision 2015* CI goals and objectives. For example, RII institutions, along with PUIs, provide nodes to the WV Global Grid Exchange<sup>87</sup> (G2EX) grid-computing initiative. Also, a 128-core cluster with over 90% utilization was established in '07 as a fee-for-service Shared Computational Facility (SCF) at WVU. In partnership with the State of Arkansas, WV was recently awarded a RII-T2 grant focused on developing an education and training program for cyber-enabling the workforce by funding "Campus Champions" at MU, WVSU and WVU. As part of the RII-T2, HPC resources—900 new computing cores and an exploratory GPU cluster—open to all WV researchers, were established at University of Arkansas Fayetteville (UAF) and a new 256-core cluster for computation and visualization support and training was established at MU.

IRT activities will further expand the CI landscape in that they need significant computational modeling and visualization efforts to enhance fundamental scientific inquiry. In simulations, an important consideration for nanodevice development is to understand how biomolecules interact with surfaces (e.g., DNA moving through a nanopore in IRT 1, charge transfer from an inorganic interface to a biomolecule in IRT 2) and flow in hybrid microfluidic channels (e.g., integrated photonic crystals in IRT1 and cell-coated channels in IRT 3). Experimental methods to study function and structure at the molecular level can be invasive or destructive; computational modeling methods such as, *atomistic classical force fields*, newly developed *coarse-grain modeling* techniques,<sup>88-92</sup> or *density-functional theory* (DFT) calculations are critical for understanding organic-inorganic interfaces and interpreting experimental data.<sup>93</sup>

**CI-Enabled Discovery and Innovation Needs.** While resources are available at UAF and through Teragrid, expansion of the SCF from the current 128-cores to 768-cores is required to meet the local needs of IRT and WVNano researchers. Expansion of this facility will allow increased computational and modeling integration into RII research and will establish the path for future growth of CI-enabled research and discovery. It will also serve as a magnet for future computational research group hires. As an example of the need for this facility, *Lewis* (WVU) is primary developer of the FIREBALL DFT program<sup>94-97</sup>. This code can accurately simulate bio/solid-state interfaces and is used by several dozen researchers throughout the world. While his research group uses Teragrid and will use RII-T2 UAF resources as well, the availability of a robust local SCF will allow *Lewis* to maintain and further develop this highly-parallelizable code before porting to Teragrid and UAF for production runs and will be

crucial to streamlining IRT-related research. The proposed RII research—specifically within each IRT—will directly benefit from these locally available modeling, visualization, code development, and communication tools (See Sec. 4.3).

**Summer Institutes for HPC.** The proposed expansion of the SCF offers an opportunity to assemble a community of users with similar computational research interests. Through Summer Institutes for HPC, the SCF at WVU will also become an educational resource available to researchers throughout WV, including faculty at PUIs and CTCs. Where the RII-T2 provides Campus Champions who mentor campus faculty as well as PUI and CTC STEM faculty in HPC concepts and tools, Summer Institutes hosted at the SCF will allow these faculty—along with their students—to explore grid-computing concepts, perform advanced computational research, collaborate with computational and experimental faculty in each of the IRTs, and eventually submit proposals to Teragrid.

WVU, in partnership with the Pittsburgh Supercomputing Center, will sponsor workshops on proposal preparation to secure CI-enabled awards and Teragrid allocations for faculty from all WV institutions. Workshop topics will include using *molecular dynamics* codes (e.g. AMBER), *coarse-grained modeling*, and *density-functional* codes (e.g. GAUSSIAN). Scientists who are leaders in their field will be invited to give lectures at these Summer Institutes. The SCF will also offer workshops to experimentalists to build their HPC skill sets. Activities will include: 1) demonstrations by researchers or vendors of visualization or analysis software; 2) nanoscience and nanotechnology research (e.g. nanoHUB) resources workshops; 3) short materials research software courses to encourage students to complement their research with computational results; and 4) computational course resources.

**Linking Instrumentation via Distance Access.** WVNano’s shared facilities have been used by faculty and students from MU and WVSU. In order to improve research and education use across institutions, institutions will enable remote operation of major instrumentation in these shared facilities. This approach removes financial and geographical barriers to research and education in WV by providing access to instrumentation that would otherwise be unavailable. For instance, in the RII-T2, MU has established CI-enabled capabilities for an AFM. WVU has also purchased SEM/e-beam lithography and TEM instruments with CI-enabled capabilities. Remote operation will be used to incorporate the microscopes into statewide outreach activities described in this proposal, including teacher classrooms in the TREK program. Furthermore, inter-institutional research collaborations for IRT 3 will be facilitated.

**Virtual Collaboratory (VC).** Tied to CI-enabled instrumentation is the creation of a virtual online collaboratory, designed initially as a portal to utilize shared CI-enabled instrumentation (online scheduling capability is in place) for faculty at WV PUIs and CTCs. This VC will serve as shared space for data storage, exchange, and analysis by researchers while developing collaborative skills of student researchers in a virtual environment; collaborative conferencing technologies will further enable this VC. The VC will serve as a bridge between remote national and international collaborators and faculty participants within WV, and enable dissemination of research results between IRTs and other faculty participants. Computer science undergraduates will be engaged in developing software for the VC; providing rich opportunities for workforce development of future WV software engineers.

Representative milestones and metrics are in Section 4.8; A formal Evaluation Plan after award will include complete criteria.

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#### 4.7 EXTERNAL ENGAGEMENT PLAN

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Multiple methods for external engagement build upon the unique contributions and far-reaching connections the three partner institutions have with their communities. While the initial core group includes WVU, MU and WVSU, there are a number of smaller, undergraduate institutions that will be engaged in coming years. Engagement of PUIs, for example, will enhance entry of minorities and first-generation college students into the rigors of STEM graduate study at WVU and MU.

**PUI/CTC Incubator Program:** The RII-supported PUI/CTC Incubator Program will be a statewide grant program focused on PUI researchers and CTC partners. Proposals from PUI faculty will be evaluated by a faculty panel from MU, WVU, and external peers. Awards will be based on: 1) collaborative potential, 2) extramural funding potential, 3) match with RII technical or educational goals, 4) presence of a CTC partner, and 5) quality of the research/education plan. Each Incubator Grant (up to \$100K annually) will be for two years. The PUI applicant and a RII senior faculty member from one of the lead institutions (WVU or MU) must collaborate. In addition, 10% of the Year 1 budget will be allocated to the senior collaborator to encourage “two-way” research interactions. However, requirement to collaborate will be optional in Year 2 to provide an opportunity for the PUI PI to gain autonomy. An extramural proposal must be submitted by the PUI PI by the end of the 18<sup>th</sup> month of the grant period.

The technical coordinator at the collaborating lead institution will be responsible for tracking progress in Year 2 and assisting in development of the external proposal. Through a formal grant writing mentoring plan, PUI PIs will be mentored through the grant writing process and in design of the research plan. The mentoring program will be implemented by the review panel for the PUI/CTC Incubator Program with external technical assistance. This program is expected to result in increases in proposal submissions from PUIs and eventual gains in statewide grant funding and productivity.

An additional component of the Incubator Grant will involve expanding TREK (Sec. 4.9.2) beyond MU, WVU and WVSU. TREK participation is limited to high school teachers and students who live near MU, WVSU, and WVU. The likelihood for active participation increases if teachers do not need to leave their families for the summer. A funding priority will be placed on Incubator Grant renewals that include a request for TREK for high schools in the PUI’s own region. Additional Year 2 funds may be requested by the PUI PI to cover this additional activity.

*Price and Georgel* (MU) currently collaborate with scientists at Glenville State College (*Sara Sawyer*) and Alderson-Broadbent College (*Charlie Chen*), respectively. PUI scientists may use funds for equipment, travel expenses, and student researchers. These collaborations will allow rapid initiation of an expanded incubator program in 2010. Also, four PUIs have been funded to enhance STEM research capacity through the State-funded RTF (\$100K each); a second competition will be held in 2010.

**Educational Programs:** An important element of an effective external engagement plan is engaging both K-12 education and higher education. These communities are targeted through multiple means and more fully described in Sections 4.4, 4.5 and 4.9.

**Outreach, Communication and Dissemination:** Overall goal of WVEPSCoR’s Outreach, Communication and Dissemination Plan is to effectively communicate results, benefits and processes of science to WV’s citizens at all education levels. These efforts will help build scientific literacy in the state and strengthen education and research capacity. Under the current RII, WVEPSCoR has greatly expanded outreach and communication efforts. A communications manager was hired; the quarterly journal of science and research, *The Neuron*, was redesigned and refocused; four large conferences were held—two statewide science, technology and research symposia, a forum for research faculty from WV’s PUIs and a national faculty diversity workshop; WVEPSCoR’s website ([www.wvresearch.org](http://www.wvresearch.org)) has been redesigned to be more user-friendly and accessible for users with disabilities; and WVEPSCoR and West Virginia Public Broadcasting collaborated on a series of news segments focusing on technology and research in WV.

Proposed activities will add several outreach and communication initiatives, as well as strengthen ongoing efforts. These include: 1) communicate the importance and benefits of STEM research by continuing publication of *The Neuron* which highlights WV STEM research and related economic development; 2) engage the general public and especially students by partnering with Cornell’s successful nanotechnology exhibition, *Nanooze- The Exhibition* (<http://www.nanooze.org>), creating ancillary learning activities to extend the experience into the classroom and developing a regional edition

of the magazine, *Nanooze*, featuring WV scientists; 3) continue the biennial statewide STaR Symposium as a forum for WV's S&T enterprise while reaching out to WV undergraduate and graduate students to showcase the program's research findings and benefits; 4) increase depth and breadth of STEM enterprise communication and outreach by enhancing WVEPSCoR's website with a "Discovery" tab highlighting findings of WV researchers and a Press Room to facilitate media access to information; and 5) contract with MetroNews Radio Networks for a year-long statewide radio campaign to increase awareness of the benefits of the research in this proposal and others. These activities will be coordinated by WVEPSCoR. WVEPSCoR also will communicate regularly with NSF EPSCoR via telephone, email and/or personal meetings to coordinate NSF involvement in Outreach and Communication activities.

#### 4.8 EVALUATION AND ASSESSMENT PLAN

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Success in the RII program will be measured through a variety of mechanisms all nucleated around a comprehensive evaluation and assessment plan utilizing qualitative and quantitative approaches to provide both formative feedback and summative assessment. Process use (self-assessment, collective knowledge generation and collaborative action) will encompass institutional perspectives and will create a learning process for the management team that will help build capacity, sustainability and institutionalization.<sup>98</sup> The management team will be actively engaged in identifying the information needed to make decisions, and in interpreting and using the evaluative data. The management team will respond to external evaluation and External Technical Advisory Board (ETAB) focusing on how recommendations will be incorporated into practice along with a timeframe for the appropriate actions. Evaluation findings will be used by the project's management team to inform processes and practices, decrease barriers to research competitiveness and develop strength for the formation of intra/inter-jurisdiction collaborations to address scientific issues of regional relevance and national importance. WVEPSCoR was one of the first jurisdictions to implement evaluation in 2006 and has been using evaluation findings to successfully inform management decisions.

Efficient metric collection and reporting is in place with *GO!*, the database developed by WVEPSCoR in FY 2008. *GO!* is especially adaptable for maintaining data that can be readily demographically disaggregated from individual to organizational levels. Education level of participants along with geographic location, race/ethnicity, gender, disability and first-generation status will be maintained.

Rose Shaw has agreed to serve as external evaluator. She is accomplished at working with multiple-site, collaborative projects and is the external evaluator of the current WV RII. Shaw has a Ph.D. (Applied Statistics), and 18 years experience evaluating over 70 projects in 14 states including NSF GK12, LSC, CETP, IGERT, RII, NUE, BD, ADVANCE, ITEST and LSAMP projects. *Within three months of the award the external evaluator and the management team will meet to formalize the evaluation plan and coordinate it with the project's strategic plan similar to the 12 page, detailed evaluation plan used by the ELT and evaluator to review and manage the current RII.*

##### **Representative Milestones:**

- ♦ Diversity commission appointed (yr 1), comprehensive plan targeting five years developed (yr 2), and implemented (yrs 3-5)
- ♦ Convene CTC working group with Chancellor (yr 1), developed articulation agreement (yr 1) and articulation agreements in place throughout the state (yr 3)
- ♦ WVI<sup>3</sup> Think Tank convened (year 1), networks formed (yr 1), and first proposals (yr 2)
- ♦ STEM Workforce development plan (yr 1), create Governor's work force develop plans (yr 2), coordinate and implement (yr 3)
- ♦ IRT faculty infused into outreach, education, diversity and workforce development activities (yr 2 – 50%; yrs 3-5 – 100%)
- ♦ Purchase and install equipment (yrs 1-4)



- ♦ Meetings with PUIs and CTCs (yr1), work plan developed (yrs 1-2), implemented (yrs 3-5)
- ♦ CI: purchase advanced CI tools (yrs 1-2), use in RII research (yrs 2-5), used by PUIs/CTCs (yrs 3-5)
- ♦ IRTs have multiple milestones including demonstration of <3 min. analysis of DNA (IRT 1, yrs. 1-2), demonstration of ppb sensitivity for heavy metals and toxins (IRT 2, yrs 4-5) and demonstration of successful cell growth on porous surface of microfluidic channels (IRT 3, yrs 1-2)
- ♦ *Carver, Jackson, Toth, Cartwright, and Woodrum* research effectiveness of LA and TREK programs: Collaboratively develop research plan (yr 1), begin pre/post testing and observations (yr 1), first presentation at state conference (yr 3), manuscript submitted (yr 4), and publication (yr 5)
- ♦ Sweeney's modification of Bainbridge's Internet survey of public attitudes toward nanotechnology<sup>99</sup> used to assess impact of undergraduate programs (yrs 1-5); results disseminated (yrs 4-5)
- ♦ Track retention of students in STEM through graduation, workforce, graduate school (yrs 1-5)

#### **Representative Deliverables, Outcome Metrics and 5-Year Benchmarks:**

- ♦ Number, quality and type of peer-reviewed publications (doubled in five years)
- ♦ Number of grants submitted to NSF/other agencies; number funded, dollar amount (50% increase)
- ♦ Number and productivity of intra/inter jurisdictional collaborative research activities (20% increase)
- ♦ Number and types of invention disclosures (25% increase)
- ♦ Number and types of patents filed, pending and granted (15% increase)
- ♦ Number and types of start-up companies (three companies)
- ♦ User groups, numbers of users and user hours per instrument (40% increase)
- ♦ Publications directly or indirectly a result of using the acquired equipment (50% of publications)
- ♦ Grant proposals and awards that utilized one or more acquired equipment (50% of publications)
- ♦ Number of seed grants to PUI and CTC faculty (4)
- ♦ Number of interdisciplinary publications (90% of publications)
- ♦ Number of PUI and CTC faculty awarded new, competitive, non-EPSCoR grant funding (10)
- ♦ Percentage of participants from targeted UREP demographic groups - geographic, 2-year and 4-year institutions, ethnic, racial, cultural, physical, gender (20% increase)
- ♦ NSF ADVANCE, GK12, Noyce and IGERT awards (at least one each)
- ♦ One externally funded center grant (e.g., MRSEC, STC)
- ♦ Retention of new RII hires (100%)
- ♦ Salary equity, faculty tenure and promotion across all UREP STEM faculty lines

#### **4.9 SUSTAINABILITY PLAN**

Infrastructure improvements will be sustained through: 1) human infrastructure and equipment secured by State [RCF ~\$4M annually and RTF] and university funds; 2) continuing efforts to increase the RCF; 3) increasing number and competitiveness of individual, group and large-scale, multidisciplinary proposals from all faculty, research clusters and partners; 4) building stronger research collaborations; 5) setting up university-wide undergraduate research education offices; and 6) setting up a post-doc and junior faculty mentoring system that will increase success of all faculty. Cyber-enabled mentoring and continued implementation of *Vision 2015* will improve policies, and financial and infrastructure support for workforce and research enterprise. The BRF and Cyber Facilities will be sustained as part of the WVNano Shared Facilities. A senior faculty member will be hired at WVU to be permanent WVNano director, will be sustained by the university and lead the transition of the program to Center status.

Appended letters of commitment demonstrate long-term support for this infrastructure improvement proposal at the highest levels of institutional and state fiduciary responsibility. After attracting and

nurturing a diverse, competitive research faculty, WV will provide support beyond the award. Equipment, maintenance, and supporting infrastructure will be sustained by the State and institutions.

#### 4.9.1 Seed Funding and Emerging Areas

**Seed Funding for High Risk/High Impact Research.** Seed funding will be provided for: 1) potentially transformative projects for researchers to gain preliminary data; 2) competitive researchers changing directions; 3) junior faculty pursuing an NSF CAREER award; and 4) innovative educational/research alliances with industry. Themes of projects must be consistent with scientific aims of the RII; proposals will be accepted annually and evaluated by external referees. NSF merit review criteria will be used with an emphasis on novelty and contribution to RII core investigations. Selection of projects for funding will be made by the Executive Leadership Team. Seed project PIs (from WVU, MU or WVSU) will be required to submit reports after 6 and 12 months. The annual report will be evaluated externally to determine if the project should receive second year renewal. Metrics include: number of papers published or submitted for publication and proposals submitted to external agencies and impact on workforce development. Seed grants will provide funding for summer salary for up to two investigators, two graduate students, materials and supplies and travel to conferences and national laboratory facilities.

**Emerging Areas of Interdisciplinary Research.** An Emerging Area has been established which focuses on cell biology and biotechnology. The Emerging Area is a unique research focus that leverages strengths at MU and WVSU and an area where investment in infrastructure will lead to new avenues of competitive research and expanded options for STEM students. WVSU and MU are in the southwest region of the state, only 40 miles apart and fulfill critical academic needs in the WV-Ohio-Kentucky tri-state region. Support for this emerging area will catalyze a regional biotech consortium with outreach to local and regional industry and academic partners in *molecular and cellular mechanisms* (e.g. *signal transduction, environmental/extracellular cues; intracellular signaling; genetic responses/genomic impacts*). Infrastructure investments including instrumentation and junior faculty support will provide the driving force for a growing a productive, interdisciplinary and collaborative research enterprise.

Over the next 1-3 years, funds will support growth of collaborative research teams formed between MU and WVSU researchers. In addition, two post doctoral fellows, 16 graduate students and 6 undergraduates will be involved with this research. To facilitate this, junior faculty will be supported and mentored. The emerging Biotech Consortium will build on existing strengths and synergistic new hires in computational biology and cellular biology. These faculty will be mentored in grantsmanship, and CAREER award-eligible faculty will be mentored by CAREER awardees from WVU. Internal and external mentors will be enlisted for these junior faculty and interactions between mentors and faculty will be supported by the RII. Over the next 2-5 years, the goal is to aggressively translate the investment in these junior faculty and make them successful in obtaining extramural grant awards, leading to growth and sustainability of the consortium. The long-term goal is to develop collaborations, research excellence and outreach stimulated by this RII and build a biotechnology corridor linking WVSU, MU and regional collaborators, and the cities of Huntington and Charleston. Economic benefits will include generation of diverse jobs at levels from lab technicians to doctorate-level scientists, business leaders and support personnel. Technical coordinators (*Price, MU; Toledo, WVSU*) will direct this effort.

#### 4.9.2 Education and Human Resources Development

WV does not produce enough graduates to fill its needs for K-12 STEM teachers. In WV, 30% of core academic classes are taught by a teacher who does not hold even a minor in the subject.<sup>100</sup> *The goal of these education programs is to recruit and retain K-12 STEM teachers who will bridge the gap of disparities for students struggling in middle-school and high-school STEM because their teacher is under-qualified for instruction.* Specific components of the plan are: 1) recruit K-12 STEM teachers through the Learning Assistants (LA) program and 2) retain middle-school and high-school STEM teachers through the TREK program. **Recruitment**

**through the LA Program:** In 2008, WVU was awarded an NSF Robert Noyce Scholarship award to recruit and retain STEM teachers. Students receive scholarships to complete the nationally recognized Benedum Collaborative 5-yr teacher training program and in exchange, Scholars agree to teach for 6 years in high need schools in WV. The LA program (led by *Carver, Jackson* at WVU; *Cartwright* at MU; and *Taylor* at WVSU) will improve STEM teacher recruitment. The LA program will serve as a pilot for future Noyce proposals from these institutions. Modeled on the successful PhysTec programs at institutions like University of Arkansas and University of Colorado at Boulder, the LA program will place early academically-successful undergraduates in introductory STEM classes with professors to assist in implementing active learning, personal response systems, peer-led team learning, and other successful pedagogies. Students serve as LAs and receive early teaching experiences while STEM and Education faculty work to enhance student learning and promote teaching as a career. LAs enroll in a two-hour education course which supports reflection on their own pedagogical practice. Most components of the program are relatively low cost which promotes a ready transition to a sustainable program<sup>101</sup>. Although PhysTEC programs contain a number of elements, the LA program was chosen as an initial pilot effort because of its benefit to participating students' performance and experiences in introductory courses. The LA program will leverage the Noyce Program by providing a strong recruitment mechanism in high need disciplines (physics and chemistry) in WV schools.<sup>102</sup> In addition to recruiting more teachers, these programs have helped improve student performance<sup>103</sup> and have contributed to an increase in STEM field majors.<sup>104</sup> It is anticipated that this program will double chemistry and physics teachers at WVU (10 new STEM teachers) by year 3 and across all institutions by year 5 (60 new teachers).

**Retention through TREK:** Professional development is critical to insure that K-12 teachers are current in their knowledge and to support their aspirations as a means to enhance retention. To train and retain WV teachers, WVEPSCoR will pilot a TREK program coordinated by *Carver, Jackson* at WVU; *Cartwright* at MU; and *Taylor* at WVSU. TREK will provide teachers with increased content knowledge, renewed enthusiasm for teaching science, and changes to teachers' lesson plans that incorporate more student research and laboratory exercise.<sup>105</sup> TREK will include summer support for teachers giving them an option for supplementary income during the summer and involve select high school students (one student/teacher) in the research experience. TREK will engage 9 in-service teachers at WVU, 3 at WVSU, and 4 at MU in authentic research experiences through integration into IRT and emerging area research annually. Each teacher will develop one instructional module directly linked to WV Content Standards and Objectives of the subject matter class they teach. Impact: *With 16 teachers participating in TREK yearly, more than 2000 students will have contact with TREK teachers each year and nearly 15,000 students over the course of the award if new teachers are recruited each year.* TREK will be expanded beyond MU, WVU and WVSU via PUI/CTC Incubator grants where more teachers and students who live near PUI campuses can participate (Sec. 4.7).

#### 4.9.3 Post RII Extramural Funding

Post-RII extramural funding will include continued institutional and state support for the BRF and cyber shared facilities and continued institutional support for the undergraduate research coordinating office to support SURE and related programs. In addition, DSR will continue to support STEM Fellowships and the dual faculty hire program. Faculty at WVU, MU and WVSU will continue to be supported to improve grant writing and growth in research awards. WVU has also developed guidelines for successful Interdisciplinary Centers (e.g. WVNano) that ensures return of indirect costs to sustain Center operations.

#### 4.10 MANAGEMENT PLAN

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**EPSCoR Governing Committee.** The WV Science and Research Council (SRC) is the governing entity of the WVEPSCoR RII program and state-sponsored research and education initiatives. By directing NSF RII, RCF and RTF programs, the SRC is positioned to provide strategic portfolio investments that assure

fidelity to *Vision 2015*. The SRC a) authorizes proposals and program implementation, b) serves as liaison to institutions, industries, and businesses, c) provides complementary support to WVEPSCoR and IDEa programs, and d) directs state research programs in concert with WV strategic objectives. The WVEPSCoR program office directly implements NSF, DOD and DOE EPSCoR programs; similar programs funded by USDA, NASA, EPA, and NIH are managed by effective committees that report to the SRC and the Director. SRC members are appointed by the Governor, hold three-year terms, and represent government, academia, and the private sector. Current members are: Chairman Dr. *Noland*, Chancellor, HEPC; K. *Goodwin*, Cabinet Secretary, Education & the Arts, Dr. *P. Balch*, Pres., WV Wesleyan University; Dr. *F. Butcher*, Interim Vice-Pres. for Health Sciences, WVU; J. *Carpenter*, Pres., Kicking Stones Consulting, Inc.; Dr. *B. Cukic*, Byrd Professor of Electrical and Computer Eng., WVU; J. *Estep*, Pres. and CEO, WV High Technology Consortium; K. *Goes*, Secretary of WV Dept. of Commerce & Exec. Dir. WV Development Office; Dr. *J. Maher*, VPR, MU; Dr. *G. Rankin*, MU School of Medicine; Dr. *S. Paine*, WV State Superintendent of Schools; and Dr. *C. Peterson*, VPR, WVU. **The SRC includes three women and an African-American male has been nominated.**

**RII Executive Leadership Team (ELT).** The ELT is the senior management of the RII program. They will meet quarterly to review progress in meeting project milestones and utilize evaluation feedback (Sec. 4.8) to modify project activities. The ELT will be the primary management interface with the PI and the NSF Program Officer. The ELT is headed by RII PI and Director, Dr. *Paul Hill*, who has successfully managed WVEPSCoR the past 7 years. Co-PIs include Drs. *Jan Taylor*, WVEPSCoR Deputy Director, who oversees evaluation and assists in program management; campus EPSCoR Coordinators, *Curt Peterson*, WVU VPR, *John Maher*, MU VPR, and *Ulises Toledo*, Assoc. Dean, Land-Grant Institute, WVSU. Dr. *David Lederman*, WVU technical coordinator, Dr. *Elmer Price*, MU technical coordinator, and Dr. *Tina Cartwright* (MU), WVI<sup>3</sup> coordinator, will also serve on the ELT. The WVNano Director (to be hired) at WVU will also serve on the ELT and help lead overall day-to-day aspects of the effort. Coordinators are responsible for project implementation and information flow among campuses, VPRs and WVEPSCoR PD. **The Team includes two Hispanic men and two women.**

**Succession.** The WV SRC will provide NSF with qualified names of replacements for current leadership should they no longer be available for service. Policies established by the SRC authorize RII proposals and ensure responsive leadership succession. To mentor and train new leadership, WVEPSCoR has created a post-doctoral position in Research Administration to assist program management duties. The nature of the post-doctoral training appointment allows development of individual(s) for potential long-term employment should the individual be well-suited for managing EPSCoR. Drs. Hill and Taylor will mentor a number of candidates over time and will seek underrepresented minority candidates as part of its diversity plan. **The newly recruited hire is female.**

**Fiscal Accountability.** Financial management of the RII is assured by the financial structure of the Finance and Facilities Division of the HEPC, fiscal agent for WVEPSCoR. *Annette Echols* is EPSCoR Program Administrator and provides financial reporting for WVEPSCoR.

**Integration Among Institutions.** The partnership among WVU, MU and WVSU will be led by the institutional leaders on the ELT. On-campus leaders, *Lederman*, *Price*, and *Toledo*, will meet via videoconference or in person at least once quarterly to assure that research, education and workforce development programs are proceeding as intended. They also will have monthly conference calls facilitated by the PI. WV SRC members include all three universities - their VPRs serve as RII coordinators on each campus and provide oversight on implementation and budgeting. Communication and partnerships are maintained within each IRT through frequent meetings and monthly progress reporting. Members of groups on all campuses will participate by videoconference or via the *Virtual Collaboratory* (Sec. 4.6). Likewise, IRT team leaders meet weekly to discuss project needs, progress reports

and to apprise other groups of new advances. Biannually, IRTs and their research teams, post-docs and students, will meet for a research retreat to share latest results and further encourage inter-IRT and inter-institutional collaborations. An annual scientific forum rotating among the three campuses will engage scientists, students and administrators and help develop collaboration opportunities both within the three university partners and with external scientists who present their research.

The PI, Dr. Hill, will assure that partnership activities are taking place as planned. Dr. Hill or co-PI, Dr. Taylor, will be interacting at least monthly with the Technical Director, Dr. Lederman, and visiting all three campuses every other month to evaluate progress and fidelity to the proposal work plan.

**Technical Assistance** External technical assistance will be provided by an External Technical Advisory Board. The ETAB will be made up of 5 national experts in the research focus areas from non-EPSCoR research institutions and one EPSCoR State Director. The Board will: (a) review annual progress reports, provide advice and make recommendations for strengthening the RII Program to the Director and SRC Chairman; and (b) make two on-campus review visits during the grant period and advise institutional officials and SRC on strengths, weaknesses and progress. The current ETAB helped evaluate, plan and develop this proposal. Two reviews during proposal preparation ensured that strength-based approaches and sound science are proposed. The current ETAB includes Drs. S. Little (SC EPSCoR), A. Guiseppe-Elie (Clemson U.), J. Boerio-Goates (BYU), G. Salamo, (U. Arkansas), J. Graham (Scripps Institute of Oceanography) and G. Kerslick (Cornell). The ETAB includes an **African-American male and a female.**

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 ETAB to the state for expert reviews; 5) assisting in development of partnerships with industry and regional university collaborations and 6) annual external reviews of seed and PUI/CTC incubator programs.

#### 4.10.1 Jurisdictional and Other Support

**Cost Share.** WVEPSCoR institutions commit \$4M in cost share to support RII investments and activities. WVU commits \$1.925M, MU \$1.125M, WVSU \$0.49M, and HEPC/WVEPSCoR \$0.46M.

**Shared Facilities.** Finances supporting the NSE shared resources operation (staff salaries, maintenance and operations costs) have been put under a single accounting umbrella, enabling effective management and assessment. The version finalized at the end of 2006 established a shared commitment on the part of users (40%), WVU (40%) and the State (20%) to support this set of shared resources. The plan was fully implemented in Spring 2007. The new BRF and HPC CI facilities will become part of this structure through a sliding scale that will ensure support past year 5 of this project.

**Table A. Research Support Levels**

<b>Awardee</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>5-yr Total</b>	<b>%</b>
WVU	1,936,605	1,950,827	2,029,123	1,922,023	1,786,422	9,625,000	48%
MU	1,088,395	1,074,173	1,120,877	1,127,977	1,21,3424	5,624,846	28%
WVSU	500,000	490,000	485,000	485,000	488,000	2,448,000	12%
PUIs & CCs	125,000	125,000	0	100,000	150,000	500,000	3%
WVHEPC	350,000	360,000	365,000	365,000	362,154	1,802,154	9%
<b>Total</b>	<b>4,000,000</b>	<b>4,000,000</b>	<b>4,000,000</b>	<b>4,000,000</b>	<b>4,000,000</b>	<b>20,000,000</b>	<b>100%</b>

- <sup>1</sup>Britt, R. K. (2008). *Survey of Research and Development Expenditures at Universities and Colleges, FY 2008*. National Science Foundation: Division of Science Resources Statistics.
- <sup>2</sup>Horseman, K. M., Bienvenue, J. M., Blaiser, K. R., & Landers, J. P. (2007). Forensic DNA analysis on microfluidic devices: A review. *Journal of Forensic Science*, 52 (4), 784.
- <sup>3</sup>Easley, C. J., Karlinsey, J. M., Bienvenue, J. M., Legendre, L. A., Roper, M. G., Feldman, S. H., et al. (2006). A fully integrated microfluidic genetic analysis system with sample-in-answer-out capability. *Proceedings of the National Academy of Sciences of the United States of America*, 103, 19272-19277.
- <sup>4</sup>Hashimoto, M., Barany, F., Xu, F., & Soper, S. A. (2007). Serial processing of biological reactions using flow-through microfluidic devices: Coupled PCR/LDR for the detection of low-abundant DNA point mutations. *Analyst (Cambridge, United Kingdom)*, 132, 913-921.
- <sup>5</sup>Beyor, N., Yi, L., Seo, T. S., & Mathies, R. A. (2009). Integrated capture, concentration, polymerase chain reaction, and capillary electrophoretic analysis of pathogens on a chip. *Analytical Chemistry (Washington, DC, United States)*, 81, 3523-3528.
- <sup>6</sup>Edwards, B. F., Timperman, A. T., Carroll, R. L., Jo, K., Mease, J. M., & Schiffbauer, J. E. (2009). Traveling-wave electrophoresis for microfluidic separations. *Physical Review Letters*, 102, 076103.
- <sup>7</sup>Zhang, Y., & Timperman, A. T. (2003). Integration of nanocapillary arrays into microfluidic devices for use as analyte concentrators. *Analyst*, 128, 537-542.
- <sup>8</sup>Miller, S. A., Kelly, K. C., & Timperman, A. T. (2008). Ionic current rectification at a nanofluidic/microfluidic interface with an asymmetric microfluidic system. *Lab on a Chip*, 8, 1729-1732.
- <sup>9</sup>Kelly, K. C., Miller, S. A., & Timperman, A. T. (2009). Investigation of zone migration in a current rectifying nanofluidic/microfluidic analyte concentrator. *Analytical Chemistry (Washington, DC, United States)*, 81, 732-738.
- <sup>10</sup>Grass, K., Holm, C., & Slater, G. W. (2009). Optimizing end-labeled free-solution electrophoresis by increasing the hydrodynamic friction of the drag-tag. *arXiv.org, e-Print Archive, Condensed Matter*, 1-32, arXiv:0902.1889v0901 [cond-mat soft]. Retrieved on October 13, 2009, from [http://arxiv.org/PS\\_cache/arxiv/pdf/0902/0902.1889v1.pdf](http://arxiv.org/PS_cache/arxiv/pdf/0902/0902.1889v1.pdf)
- <sup>11</sup>Won, J. I., Meagher, R. J., & Barron, A. E. (2005). Protein polymer drag-tags for DNA separations by end-labeled free-solution electrophoresis. *Electrophoresis*, 26, 2138-2148.
- <sup>12</sup>Dongre, C., Dekker, R., Hoekstra, H. J., Pollnau, M., Martinez-Vazquez, R., Osellame, R., et al. (2008). Fluorescence monitoring of microchip capillary electrophoresis separation with monolithically integrated waveguides. *Optics Letters*, 33, 2503-2505.
- <sup>13</sup>Vazquez, R. M., Osellame, R., Nolli, D., Dongre, C., van den Vlekkert, H., Ramponi, R., et al. (2009). Integration of femtosecond laser written optical waveguides in a lab-on-chip. *Lab on a Chip*, 9, 91-96.
- <sup>14</sup>Ganesh, N., Zhang, W., Mathias, P.C., Chow, E., Soares, J.A.N.T., Malyarchuk, V., et al. (2007). Enhanced fluorescence emission from quantum dots on a photonic crystal surface. *Nature Nanotechnology*, 2, 516.

- <sup>15</sup> Dawson, J. M., Nightingale, J. R., Tompkins, R. P., Yeldandi, S., Myers, T. H., Jo, K., et al. (2008). Design and characterization of optofluidic photonic crystal structures for the detection of fluorescent-labeled biomolecules. *ECS Transactions*, 13 (22), 27.
- <sup>16</sup> Dawson, J. M., Nightingale, J. R., Tompkins, R. P., Cao, X., Myers, T. H., Hornak, L. A., & Korakakis, D. (2008). GaN photonic crystal-based, enhanced fluorescence biomolecule detection system. *Materials Research Society Symposium Proceedings*, 1040, Q09-29.
- <sup>17</sup> Wang, Z. B., Ye, Y. H., & Zhang, J. Y. (2007). Modified spontaneous emission from dye molecules inside a photonic crystal microcavity. *Chinese Physics Letters*, 24 (8), 2252.
- <sup>18</sup> Chan, L. L., Gosangari, S. L., Watkin, K. L., & Cunningham, B. T. (2007). *High throughput cytotoxicity screening using photonic crystal biosensors*. Paper presented at the 14th International Conference on Solid-State Sensors, Actuators and Microsystems, Lyon, France.
- <sup>19</sup> Ouyang, H., & Fauchet, P. M. (2005). *Biosensing using porous silicon photonic bandgap structures*. Paper presented at the meeting of SPIE Optics East, Boston, Massachusetts.
- <sup>20</sup> Skivesen, N., Têtu, A., Kristensen, M., Kjems, J., Frandsen, L. H., & Borel, P. I. (2007). Photonic-crystal waveguide biosensor. *Optics Express*, 15 (6), 3170.
- <sup>21</sup> Mirkarimi, L. W., Zlatanovic, S., Sigalas, M. S., Bynum, M.A., Robotti, K., Chow, E., & Grot, A. (2006). *Toward single molecule detection with photonic crystal microcavity biosensors*. Paper presented at Digest of the LEOS Summer Topical Meetings, Quebec City, Quebec, Canada.
- <sup>22</sup> Chow, E., Grot, A., Mirkarimi, L. W., Sigalas, M., & Girolami, G. (2004). Ultracompact biochemical sensor built with two-dimensional photonic crystal microcavity, *Optics Letters*, 29 (10), 1093.
- <sup>23</sup> Nguyen, T. H., Bomann, J., Leermakers, M., & Baeyens, W. (1998). Mercury analysis in environmental samples by EDXRF and CV-AAS. *Fresenius' Journal of Analytical Chemistry*, 360, 199–204.
- <sup>24</sup> Debrah, E., Denoyer, E. R., & Tyson, J. F. (1996). Flow injection determination of mercury with preconcentration by amalgamation on a gold–platinum gauze by inductively coupled plasma mass spectrometry. *Journal of Analytical Atomic Spectrometry*, 11, 127-132.
- <sup>25</sup> Santos, F. J., & Galceran, M. T. (2003). Modern developments in gas chromatography-mass spectrometry-based environmental analysis. *Journal of Chromatography A*, 1000, 125.
- <sup>26</sup> Pico, Y., Blasco, C., & Font, G. (2004). Environmental and food applications of LC-tandem mass spectrometry in pesticide-residue analysis: An overview. *Mass Spectrometry Review*, 23, 45.
- <sup>27</sup> Ghanem, A., Bados, P., Perreau, F., Benabdallah, R., Plagellat, C., de Alencastro, L. F., et al. (2008). Multiresidue analysis of atrazine, diuron and their degradation products in sewage sludge by liquid chromatography tandem mass spectrometry. *Analytical and Bioanalytical Chemistry*, 391, 345.
- <sup>28</sup> Murkovic, I., & Wolfbeis, O. S. (1997). Fluorescence-based sensor membrane for mercury (II) detection. *Sensors and Actuators B: Chemical*, 39, 246 – 251.
- <sup>29</sup> Kim, Y., Johnson, R. C., & Hupp, J. T. (2001). Gold nanoparticle-based sensing of “spectroscopically silent” heavy metal ions. *Nano Letters*, 4, 165-167.
- <sup>30</sup> Chae, M. Y., & Czarnik, A. W. (1992). Enhanced fluorescence detection of a quenching metal-application T fluorometric HG(II) and AG(I) analyses in water. *Journal of the American Chemical Society*, 114, 9704–9705.

- <sup>31</sup> Blake, D. A., Jones, R. M., Blake, R. C., Pavlov, A. R., Darwish, I. A., & Yu, H. (2001). Antibody-based sensors for heavy metal ions. *Biosensors & Bioelectronics*, 16, 799-809.
- <sup>32</sup> Amine, A., Mohammadi, H., Bourais, I., & Palleschi, G. (2006). Enzyme inhibition-based biosensors for food safety and environmental monitoring. *Biosensors & Bioelectronics*, 21, 1405-142.
- <sup>33</sup> Verma, N., & Singh, M. (2005). Biosensors for heavy metals. *BioMetals*, 18, 121-129.
- <sup>34</sup> Ono, A., & Togashi, H. (2004). Highly selective oligonucleotide-based sensor for mercury(II) in aqueous solutions. *Angewandte Chemie International Edition*, 43, 4300-4302.
- <sup>35</sup> Lee, J. S., Han, M. S., & Mirkin, C. A. (2007). Colorimetric detection of mercuric Ion (Hg<sup>2+</sup>) in aqueous media using DNA-functionalized gold nanoparticles. *Angewandte Chemie International Edition*, 46, 4093-4096.
- <sup>36</sup> Nunes, G. S., & Barceló, D. (1998). Electrochemical biosensors for pesticide determination in food samples. *Analisis*, 26, 156-159.
- <sup>37</sup> Raman Suri, C., Boro, R., Nangia, Y., Gandhi, S., Sharma, P., Wangoo, N., et al. (2009). Immunoanalytical techniques for analyzing pesticides in the environment. *Trends in Analytical Chemistry*, 28, 29-39.
- <sup>38</sup> Watkins, J. J., Zhang, B., & White, H. S. (2005). Electrochemistry at nanometer-scaled electrodes. *Journal of Chemical Education*, 82, 712-719.
- <sup>39</sup> Arrigan, D. W. M. (2004). Nanoelectrodes, nanoelectrode arrays and their applications. *Analyst*, 129, 1157-1165.
- <sup>40</sup> Li, H., & Wu, N. Q. (2008). A large-area nanoscale gold hemisphere pattern as a nanoelectrode array, *Nanotechnology*, 19(27), 275301.
- <sup>41</sup> Davies, T. J., & Compton R. G. (2005). The cyclic and linear sweep voltammetry of regular and random arrays of microdisc electrodes: Theory. *Journal of Electroanalytical Chemistry*, 585, 63-82.
- <sup>42</sup> Moretto, L. M., Pepe, N., & Ugo P. (2004). Voltammetry of redox analytes at trace concentrations with nanoelectrode ensembles, *Talanta*, 62, 1055-1060.
- <sup>43</sup> Bard A. J., & Faulkner L. R. (2001). *Electrochemical Methods* (2nd ed.). New York: John Wiley & Sons, Inc.
- <sup>44</sup> Wu, N. Q., Fu, L., Su, M., Aslam, M., Wong, K. C., & Dravid, V. P. (2004). Interaction of fatty acid monolayers with cobalt nanoparticles. *Nano Letters*, 4, 383-386.
- <sup>45</sup> Lim, M., Feng, K., Chen, X., Wu, N. Q., Raman, A., Gawalt, E. S., et al. (2007). Adsorption and desorption of stearic acid self-assembled monolayer on aluminum oxide. *Langmuir*, 23, 2444-2452.
- <sup>46</sup> Baker, B. R., Lai, R. Y., Wood, M. S., Doctor, E. H., Heeger, A. J., & Kevin, W. (2006). PlaxcoAn electronic, aptamer-based small-molecule sensor for the rapid, label-free detection of cocaine in adulterated samples and biological fluids. *Journal of the American Chemical Society*, 128, 3138-3139.
- <sup>47</sup> Jayasena, S. D. (1999). aptamers: An emerging class of molecules that rival antibodies in diagnostics. *Clinical Chemistry* 45(9), 1628-1650.
- <sup>48</sup> <http://www.simbiosys.ca/ehits/index.html>
- <sup>49</sup> Locuson, C. W., Gannett, P. M., Ayscue, R. R., Tracy, T. S. (2007). Discovery of heteroactivators of cytochromes P450 using virtual library screening. *Journal of Medical Chemistry*, 50, 1158-1165.



- <sup>50</sup> Stojanovic, M. N., de Prada, P., Landry, D. W. (2001). Aptamer-based folding fluorescent sensor for cocaine. *Journal of the American Chemical Society*, *123*, 4928-4931.
- <sup>51</sup> Gannett, P. M., Heavner, S., Daft, J. R., Shaughnessy, K. H., Epperson, J. D., & Greenbaum, N. L. (2003). Synthesis, properties, and NMR studies of a C8-phenylguanine modified oligonucleotide that preferentially adopts the Z-DNA conformation. *Chemical Research in Toxicology*, *16*, 1385-1394.
- <sup>52</sup> Heavner, S. & Gannett, P. M. (2005). Molecular dynamics and free energy calculations of the B and Z forms of C8-arylguanine modified oligonucleotides. *Journal of Biomolecular Structure and Dynamics*, *23*, 203-219.
- <sup>53</sup> Erdem, A., Kerman, K., Meric B., & Ozsoz M. (2001). Methylene blue as a novel electrochemical hybridization indicator. *Electroanalysis*, *13*, 219.
- <sup>54</sup> Tani, A., Thomson, A. J., & Butt J. N. (2001). Methylene blue as an electrochemical discriminator of single- and double-stranded oligonucleotides immobilised on gold substrates. *Analyst*, *126*(10), 1756-1759.
- <sup>55</sup> Yang, M., Wang, J., Li, H., Zheng, J. G., & Wu, N. Q. (2008). A lactate electrochemical biosensor with a titanate nanotube as direct electron transfer promoter. *Nanotechnology*, *19*(7), 075502.
- <sup>56</sup> Clarke, L. L., Gawenis, L. R., Hwang, T. C., Walker, N. M., Gruis, D. B., & Price, E. M. (2004). A domain mimic increases DeltaF508 CFTR trafficking and restores cAMP-stimulated anion secretion in cystic fibrosis epithelia. *American Journal of Physiology-Cell Physiology*, *287*(1), 192-199.
- <sup>57</sup> Gabriel, S. E., Price, E. M., Boucher, R. C. & Stutts, M. J. (1992). Small linear chloride channels are endogenous to nonepithelial cells. *American Journal of Physiology*, *263*(3), 708-713.
- <sup>58</sup> Ingram, D. G., Newcomer, S. C., Price, E. M., Eklund, K. E., McAllister, R. M., & Laughlin, M. H. (2007). Chronic nitric oxide synthase inhibition blunts endothelium-dependent function of conduit coronary arteries, not arterioles. *American Journal of Physiology- Heart and Circulatory Physiology*, *292*(6), 2798-2808.
- <sup>59</sup> Woodman, C. R., Price, E. M., & Laughlin, M. H. (2002). Aging induces muscle-specific impairment of endothelium-dependent dilation in skeletal muscle feed arteries. *Journal of Applied Physiology*, *93*(5), 1685-1690.
- <sup>60</sup> Wang, L., Toledo, D., Malanga, C. J., Ma, J. K. H., & Rojanasakul, Y. (1993). Transport and hydrolysis of enkephalins in cultured alveolar epithelial monolayers. *Pharmaceutical Research*, *10*, 1662-1667.
- <sup>61</sup> Deshpande, D., Toledo, D., Wang, L., Malanga, C. J., Ma, J. K. H., & Rojanasakul, Y. (1994). Receptor-mediated peptide delivery in pulmonary epithelial monolayers. *Pharmaceutical Research*, *11*, 1121-1126.
- <sup>62</sup> Xia, C., Meng, Q., Liu, L., Rojanasakul, Y., Wang, X. R., & Jiang, B. H. (2007). Reactive oxygen species regulate angiogenesis and tumor growth through vascular endothelial growth factor. *Cancer Research*, *67*, 10823-10830.
- <sup>63</sup> Komen, J., Wolbers, F., Franke, H. R., Andersson, H., Vermes, I., & van den Berg, A. (2008). Viability analysis and apoptosis induction of breast cancer cells in a microfluidic device: effect of cytostatic drugs. *Biomedical Microdevices*, *10*(5), 727-737.
- <sup>64</sup> Azad, N., Vallyathan, V., Wang, L., Tantishaiyakul, V., Stehlik, C., Leonard, S. S., & Rojanasakul, Y. (2006). S-nitrosylation of Bcl-2 inhibits its ubiquitin-proteasomal degradation: A novel anti-apoptotic mechanism that suppresses apoptosis. *Journal of Biological Chemistry*, *281*, 34124-34134.

- <sup>65</sup> Ganikhanov, F., Evans C. L., Saar, B. G., et al. (2006). High-sensitivity vibrational imaging with frequency modulation coherent anti-Stokes Raman scattering (FM CARS) microscopy. *Optics Letters*, 31, 1872-1874.
- <sup>66</sup> Pfeffer, C.P., Olsen, B., Ganikhanov, F., & Legare, F. (2008). Multimodal nonlinear optical imaging of collagen arrays. *Journal of Structural Biology*, 164, 140-147.
- <sup>67</sup> Uzunbajakava, N., Lenferink, A., Kraan, Y., Volokhina, E., Vrensen, G., Greve, J., & Otto, C. (2003). Nonresonant confocal raman imaging of DNA and protein distribution in apoptotic cells. *Biophysical Journal*, 84, 3968-3981.
- <sup>68</sup> Woodman, C. R., Muller, J. M., Rush, J. W., Laughlin, M. H., & Price, E. M. (1999). Flow regulation of ecNOS and Cu/Zn SOD mRNA expression in porcine coronary arterioles. *American Journal of Physiology*, 276, 1058-1063.
- <sup>69</sup> Woodman, C. R., Price, E. M., & Laughlin, M. H. (2005). Shear stress induces eNOS mRNA expression and improves endothelium-dependent dilation in senescent soleus muscle feed arteries. *Journal of Applied Physiology*, 98(3), 940-946.
- <sup>70</sup> Hattersley, S. M., Dyer, C. E., Greenman, J., & Haswell, S. J. (2008). Development of a microfluidic device for the maintenance and interrogation of viable tissue biopsies. *Lab Chip*, 8(11), 1842-1846.
- <sup>71</sup> Plouffe, B. D., Kniazeva, T., Mayer, J. E., Murthy, S. K., & Sales, V. L. (2009). Development of microfluidics as endothelial progenitor cell capture technology for cardiovascular tissue engineering and diagnostic medicine. *FASEB Journal*, 23, 3309-3314
- <sup>72</sup> Rojanasakul, Y., L. Wang, M. Bhat, D.D. Glover, C.J. Malanga, and J.K.H. Ma, *Transport barrier of epithelia: A comparative study on permeability and charge selectivity*. *Pharm Res*, 1992. 9:p. 1033-8.
- <sup>73</sup> Komen, J., Wolbers, F., Franke, H. R., Andersson, H., Vermes, I., & van den Berg, A. (2008). Viability analysis and apoptosis induction of breast cancer cells in a microfluidic device: Effect of cytostatic drugs. *Biomedical Microdevices*, 10(5), 727-737.
- <sup>74</sup> West Virginia Higher Education Policy Commission Database (2008).
- <sup>75</sup> CEOs for Cities (2008). *CityDividends: Gains from Improving Metropolitan Performance*. Retrieved on October 13, 2009, from [http://www.ceosforcities.org/files/City\\_DividendsFINAL.pdf](http://www.ceosforcities.org/files/City_DividendsFINAL.pdf)
- <sup>76</sup> [http://www.wvresearch.org/index.php?option=com\\_content&task=view&id=160&Itemid=45](http://www.wvresearch.org/index.php?option=com_content&task=view&id=160&Itemid=45)
- <sup>77</sup> Department of Higher Education State of Connecticut (2007). *Strategic Plan to Ensure Racial and Ethnic Diversity in Connecticut Public Higher Education: 2007Annual Report*. Retrieved on August 24, 2009, from <http://www.ctdhe.org/info/pdfs/2007/2007StrategicPlan.pdf>
- <sup>78</sup> Minnesota State Colleges and Universities (2009). *Diversity and Multiculturalism: A Division of the Office of the Chancellor*. Retrieved on August 24, 2009, from <http://www.diversity.mnscu.edu/>
- <sup>79</sup> University of Cincinnati (2007). *Report of the President's UC/21 Diversity Task Force*. Retrieved on August 20, 2009, from [http://www.uc.edu/sas/documents/diversity/dtfreport\\_final.pdf](http://www.uc.edu/sas/documents/diversity/dtfreport_final.pdf)
- <sup>80</sup> West Virginia Higher Education Policy Commission Database (2008).
- <sup>81</sup> West Virginia Higher Education Policy Commission Database (2008).
- <sup>82</sup> Westerlund, J. F., Garcia, D. M., Koke, J. R., Taylor, T. A., & Mason, D. S. (2002). Summer scientific research for teachers: The experience and its effect. *Journal of Science Teacher Education*, 13(1), 63-83.

- <sup>83</sup> Morrison, J. A., Raab, F., & Ingram, D. (2009). Factors influencing elementary and secondary teachers' views on the nature of science. *Journal of Research in Science Teaching*, 46(4), 384-403.
- <sup>84</sup> National Science Board. (2008). *The Science and Engineering Workforce: Realizing America's Potential (NSB03-69)*. Retrieved on August 15, 2009, from <http://www.nsf.gov/nsb/documents/2003/nsb0369/nsb0369.pdf>
- <sup>85</sup> Porter, J.C. (1995). Facilitating cultural diversity. *Journal of Management in Engineering*, 11, 39.
- <sup>86</sup> Siegel, D. (2008). Building a pipeline for diversity through intersectoral collaboration. *Higher Education*, 55, 519-35.
- <sup>87</sup> <http://globalgridexchange.com/>
- <sup>88</sup> Das, A., & Andersen, H. C. (2009). The multiscale coarse-graining method. III. A test of pairwise additivity of the coarse-grained potential and of new basis functions for the variational calculation. *The Journal of Chemical Physics*, 131(3), 34102-34111.
- <sup>89</sup> Krishna, V., Noid, W. G., & Voth, G. A. (2009). The multiscale coarse-graining method. IV. Transferring coarse-grained potentials between temperatures. *The Journal of Chemical Physics*, 131(2), 24103-24112.
- <sup>90</sup> Mirijanian, D. T., & Voth G. A. (2008). Unique elastic properties of the spectrin tetramer as revealed by multiscale coarse-grained modeling. *Proceedings of the National Academy of Sciences*, 105(4), 1204-1208.
- <sup>91</sup> Noid, W. G., Chu, J. W., Ayton, G. S., Krishna, V., Izvekov, S., Voth, G. A., et al. (2008). The multiscale coarse-graining method. I. A rigorous bridge between atomistic and coarse-grained models. *The Journal of Chemical Physics*, 128(24), 244114-244121.
- <sup>92</sup> Noid, W.G., Liu, P., Wang, Y., Chu, J.W., Ayton, G. S., Izvekov, S., et al. (2008). The multiscale coarse-graining method. II. Numerical implementation for coarse-grained molecular models. *The Journal of Chemical Physics*, 128(24), 244115-244120.
- <sup>93</sup> Harding, J. H., Duffy, D. M., Sushko, M. L., Rodger, P. M., Quigley, D., & Elliott, J. A. (2008). Computational techniques at the organic/inorganic interface in biomineralization. *Chemical Reviews*, 108(11), 4823-4854.
- <sup>94</sup> Otero, G., Biddau, G., Sanchez-Sanchez, C., Caillard, R., Lopez, M. F., Rogero, C., et al. (2008). Fullerenes from aromatic precursors by surface-catalysed cyclodehydrogenation. *Nature*, 454(7206), 865-U19.
- <sup>95</sup> Wang, H., Cheatham, T. E., Gannett, P. M., & Lewis, J. P. (2009). Differential electronic states observed during A-B DNA duplex conformational transitions. *Soft Matter*, 5, 685.
- <sup>96</sup> Wang, J., Tafen, D. N., Lewis, J. P., Hong, Z., Manivannan, A., Zhi, et al. (2009). Origin of photocatalytic activity of nitrogen-doped TiO<sub>2</sub> nanobelts. *Journal of American Chemical Society*, 131, 12290-12297.
- <sup>97</sup> Keith, J. B., Wang, H., Fultz, B., & Lewis, J. P. (2008). Ab initio free energy of vacancy formation and mass-action kinetics in vis-active TiO<sub>2</sub>. *Journal of Physics: Condensed Matter*, 20(2), 022202.
- <sup>98</sup> Cousins, J. B., Goh, S., Clark, S., & Lee, L. (2004). Integrating evaluative inquiry into the organizational culture: A review and synthesis of the knowledge base. *Canadian Journal of Program Evaluation*, 19(2), 99-141.
- <sup>99</sup> Sweeney, A. E. (2006). Social and ethical dimensions of nanoscale science and engineering research. *Science and Engineering Ethics*, 12, 435-64.

- <sup>100</sup> Jerald, C. D., & Ingersoll, R. M. (2002). All talk, no action: Putting an end to out-of-field teaching. *The Education Trust*, 1-14.
- <sup>101</sup> Mervis, J. (2007). A new twist on training teachers. *Science*, 316(5829), 1270 – 1277.
- <sup>102</sup> West Virginia Department of Education (2007). State Superintendent's Report on West Virginia's Teacher Shortage: A Focus on Mathematics, Science and World Languages. Retrieved on August 14, 2009, from [http://www.wvft.org/shared/content\\_objects/pdf//2007teachershortagereport.pdf](http://www.wvft.org/shared/content_objects/pdf//2007teachershortagereport.pdf)
- <sup>103</sup> Otero, V., Finkelstein, N., McCray, R., & Pollock, S. (2006). Who is responsible for preparing science teachers? *Science*, 313(28), 445.
- <sup>104</sup> Stewart, G. (2007). Teacher recruitment at the University of Arkansas. *Forum on Education of The American Physical Society Fall 2006 / Spring 2007 Newsletter*. Retrieved on September 20, 2009, from <http://www.aps.org/units/fed/newsletters/fall06-spring07/gstewart.html>
- <sup>105</sup> Westerlund, J. F., Garcia, D. M., Koke, J. R., Taylor, T. A., & Mason, D. S. (2002). Summer scientific research for teachers: The experience and its effect. *Journal of Science Teacher Education*, 13(1), 63-83.

## Biographical Sketch

### Paul L. Hill, Jr., Ph.D.

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WV Higher Education Policy Commission  
1018 Kanawha Blvd E. Ste. 1101  
Charleston, WV 25301

**Phone:** 304.558.4128 x 1

**E-Mail:** paul.hill@wvresearch.org

### 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

2007-present Vice Chancellor, Higher Education Policy Commission, Division of Science and Research

2001-present Executive Director, NSF and West Virginia EPSCoR Program

1997-2000 Chairman and 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) Publications most closely related to proposal

Hill, P. L., Jr. (2008, Fall). Biotechnology in West Virginia: What will it take to realize the economic development benefits? *Capacity*, 19-21.

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

Hill, P. L., Jr., & Cole, J. (2007, October 7). Sputnik: It's time for another science education drive in the United States. *Charleston [WV] Sunday Gazette-Mail*, p. C12.

Hill, P. L., Jr., & Treacy, D. H. (1989). Wetlands protection through the 401 federal certification program in West Virginia. *National Wetlands*, 11(8). Washington, DC: Environmental Law Institute.

Santos, S. L., Hill, P. L., Jr., & Gutenson, D. (1993). The Kanawha Valley Risk Communication Research Project: Lessons learned [Abstract]. *Proceedings of the Annual Conference of the Society for Risk Analysis*.

#### (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). Washington, DC: U.S. Government Printing Office.

Bosserman, R. W., Mitsch, W. J., Hill, P. L., Jr., Smith, F. L., & Taylor, J. R. (1981). Modeling and management of wetlands in the western coalfields of Kentucky. In P. M. McCaffrey, T.

Beemer, & S.E. Gatewood (Eds.), *Progress in Wetlands Utilization and Management*. Tallahassee, FL: Coordinating Council on the Kissimmee River Valley.

Hill, P. L., Jr., Taylor, J. R., & Ollis, R. R. (1991). *West Virginia discharge reduction scorecard: Pollution reduction and prevention in West Virginia chemical industry*. Charleston, WV: National Institute for Chemical Studies.

Hill, P. L., Jr., et al. (1998). *Summary report: Nitrogen asphyxiation: Union Carbide Corporation Facility, Hahnville, LA* (USCSHIB Publication Report No. 98-05-I-LA). Washington, DC: U.S. Government Printing Office.

Hill, P. L., Jr., & Taylor, J. R. (1996). *Transportation of hazardous materials in the Kanawha Valley of West Virginia*. Charleston, WV: National Institute for Chemical Studies.

#### **d. Synergistic Activities**

1. Reviewer, USEPA, NSF technical documents, proposals; served on USEPA's Advisory Committee on Implementation of the Clean Air Act Amendments of 1990
2. 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 (1993) and Paris, France (1996)
3. Led effort to develop first consolidated U.S. electronic database for chemical accident information for research on causality and incidence
4. Youth science education volunteer
5. NSF Reviewer; EPSCoR Foundation; Hawaii EPSCoR State Committee; External Monitoring

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Apon, A.	Univ. of Arkansas	Khonsari, M.	Louisiana State Univ.
Aulick, H.	West Virginia Univ.	Lederman, D.	West Virginia Univ.
Batt, C.	Cornell University	Little, T. S.	Univ. of South Carolina
Boerio-Goates, J.	Brigham Young Univ.	Peterson, C.	West Virginia Univ.
Cole, J.	West Virginia Univ.	Price, E.	Marshall University
Gillespie, R.	West Virginia Univ.	Price, D.	University of Hawaii
Giuseppe-Elie, A.	Clemson University	Salamo, G.	University of Arkansas
Graham, J.	Scripps Ocean. Inst.	St. Omeear, I.	University of Kentucky
Hallar, B.	WV HEPC	Sun, W.	Drexel University
Harrison, M.	Marshall University	Taylor, J.	WV HEPC
Hornak, L.	West Virginia Univ.	Toledo, J. U.	WV State University
Maher, J.	Marshall University	Tseng, R.	University of Hawaii
Kerslick, G.	Cornell University		

##### **(ii) Graduate and Postdoctoral Advisors**

<b>M.S. Advisor:</b>	Dr. Donald C. Tarter	Marshall University
<b>Ph.D. Advisor:</b>	Dr. Robert W. Bosserman	University of Louisville
<b>Postgraduate Sponsor:</b>	Dr. Ronald M. Atlas	University of Louisville

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Robin R. Ollis, Pamela L. Nixon—M. S. students—West Virginia State University

**Postgraduate-Scholar Sponsor:** Brittan Hallar, HEPC

**Number of graduate students advised:** 2

**Number of postdoctoral scholars sponsored:** 1

## Biographical Sketch

### John M. Maher, Ph. D.

Vice President for Research  
Marshall University  
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E-mail: maherj@marshall.edu

### a. Professional Preparation

Cornell University	Chemistry	A.B. 1976
Harvard University	Chemistry	M. S. 1981
Harvard University	Chemistry	Ph.D. 1986

### b. Appointments

2007-present	Vice President for Research at Marshall University
2003-present	Founding Partner, Rampant Technology Partners, LLC
2003-2007	Executive Director, Chemical Alliance Zone, Inc.
2001-2003	Senior Technical Leader, Corporate R/D, Dow Chemical Company
1995-2001	Senior Technology Manager, Solvents and Intermediates Division Union Carbide Corporation
1994-1995	Senior Technology Manager, Acrylates and Acetyls, Solvents and Intermediates, Union Carbide Corporation
1991-1994	Group Leader/Technology Manager, Vinyl, Acetate and Acrylics, Union Carbide Corporation
1989-1991	Group Leader/Technology Manager – Photoresist and Advanced Coatings R/D, Union Carbide Corporation
1987-1989	Research Scientist, Union Carbide Corporation
1984-1987	Project Scientist, Union Carbide Corporation
1981-1984	Senior Chemist, Union Carbide Corporation

### c. Publications

#### (i) Publications most closely related to proposal

Maher, J. M., & Cooper, N. J. (1980). Reduction of carbon dioxide to carbon monoxide by transition metal dianions. *Journal of the American Chemical Society*, 102, 7604.

Beatty, R. P., Maher, J. M., & Cooper, N.J. (1981). Alkylidene complexes from reactions of transition metal dianions with imminium salts: Synthesis and characterization of Mo(CO)<sub>5</sub>CPh<sub>2</sub>. *Journal of the American Chemical Society*, 103, 238.

Maher, J. M., Beatty, R. P., & Cooper, N. J. (1982). Preparation of dianions of molybdenum and tungsten. *Organometallics*, 1, 215.

Maher, J. M., Lee, G. R., & Cooper, N. J. (1982). Evidence for oxide transfer from coordinated carbon dioxide to coordinated carbon dioxide in an anionic carbon dioxide complex. *Journal of the American Chemical Society*, 104, 6797.

Maher, J. M., Fox, J. R., Cooper, N. J., & Foxman, B. F. (1984). Anionic alkyne complexes of tungsten. *Journal of the American Chemical Society*, 106, 2347.

#### (ii) Other publications

Maher, J. M., Beatty, R. P., & Cooper, N. J. (1985). Preparation of dianions of molybdenum and tungsten. *Organometallics*, 4, 1354.

Lee, G. R., Maher, J. M., & Cooper, N. J. (1987). Reductive disproportionation of carbon dioxide by dianionic carbonylmetallates of the transition metals. *Journal of the American Chemical Society*, 109, 2956.

Maher, J. M., Beatty, R. P., Lee, G. R., & Cooper, N. J. (1986). Preparation of dianions of molybdenum and tungsten. In R. B. King and J. J. Eisch (Eds.), *Organometallic syntheses: Vol. 3*. Amsterdam: Elsevier.

**d. Synergistic Activities**

1. Recipient, Chairman's Award for Technology Excellence – Union Carbide's highest technical award for discovery, development and commercialization of a new class of hydroformylation catalysts, 1995
2. Recipient, R/D 100 Award – for development of diorganophosphite catalysts, 1989
3. PI or Co-PI, Department of Energy research grant (\$160,000), 2004-2006

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

**Collaborators and Co-Authors (within 48 months):** none

**Co-Editors: (within 24 months):** none

**(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisor:** E. J. Corey, R. B. Woodford, N. J. Cooper—Harvard University

**Postdoctoral Sponsor:** none

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** none

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** none

**Number of postdoctoral scholars sponsored:** none



## Biographical Sketch

### Curt M. Peterson, Ph. D.

Vice President for Research and Economic Development  
President, WVU Research Corporation  
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mail.wvu.edu

### a. Professional Preparation

Moorhead State University, MN  
University of Oregon

Biology  
Biology

B.S. 1966  
Ph.D. 1970

### b. Appointments

2007-present	Vice President for Research and Economic Development, President, WVU Research Corporation, West Virginia University
2005-2007	Associate Vice President for Research, West Virginia University
2004-2005	Interim Dean, College of Arts and Sciences, University of Northern Colorado
2003-2004	Interim Associate Dean, College of Arts and Sciences, University of Northern Colorado
1997-2003	Professor and Chair, Department of Biological Sciences, University of Northern Colorado
1996-1997	Professor and Interim Coordinator, Plant Tissue Culture Facility, Auburn University
1994-1996	Professor and Acting Head, Department of Botany and Microbiology, Auburn University
1984-1997	Professor, Auburn University
1976-1987	Associate Professor, Auburn University
1979-1980	Plant Physiologist, USDA-ARS Experiment Station, Pendleton, OR
1971-1976	Assistant Professor, Auburn University

### c. Publications

#### (i) Publications most closely related to proposal

Peterson, C. M., Chen, L., Dute, R., & Kelley, M. N. (2003). Anatomical and ultrastructural observations of petiole abscission in cotton (*Gossypium hirsutum* L.). *Proceedings of the 6<sup>th</sup> Multinational Congress on Microscopy – European Extension*, 57-58.

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

Kuang, A., Peterson, C. M., & Dute, R. R. (1992). Leaf abscission in soybean: Cytochemical and ultrastructural changes following benzylaminopurine treatment. *Journal of Experimental Biology*, 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., Peterson, C. M., & Dute, R. R. (1991). Pedicel abscission of soybean: Cytological and ultrastructural changes induced by auxin and ethephon. *Canadian Journal of Botany*, 69, 2177-2186.

#### (ii) Other publications

Pritchard, S. G., Peterson, C. M., Prior, S. A., Runion, G. G., & Rogers, H. H. (1997). Effects of elevated CO<sub>2</sub>, 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., Rogers, H. H., & Peterson, C. M. (1997). Elevated atmospheric CO<sub>2</sub> 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., Boote, K. J., White, J. W., & Peterson, C. M. (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., Peterson, C. M., Boote, K. J., & White, J. W. (1997). Early-season growth as a function of leaf photosynthetic traits in common bean. *Field Crops Research*, 54, 163-172.

Pritchard, S. G., Prior, S. A., Rogers, H. H., & Peterson, C. M. (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.

#### **d. Synergistic Activities**

1. Co-PI and principal author of the Education, Human Resource Development, and Outreach (EHRDO) section of the current NSF RII award to WVEPSCoR focusing on retention and completion of undergraduate STEM students, recruitment and completion of STEM doctoral students, STEM undergraduate research experiences, and mentoring of junior faculty to promote their professional development
2. Principal WVU administrator who contributed to the development of the joint KY-WV LSAMP award made in 2006 and currently in progress
3. Principal investigator of grants from the Colorado Commission on Higher Education and the Colorado Department of Education 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
4. Participated in the development of an NSF grant for the Center for Learning and Teaching in the West, ≈ \$10M, 2001-2005; the Center represented a five-university collaborative between UNC, CSU, Montana State University, the University of Montana, and Portland State University
5. Project director, United Negro College Fund/Merck Development Award to support a UNCF/Merck Undergraduate Science Scholarship Award, 2001-2002

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Mridul Gautam	West Virginia University
Paul Hill	WV HEPC, Division of Science and Research
Lawrence Hornak	West Virginia University
David Lederman	West Virginia University
Angela Morrow	Independent

##### **(ii) Graduate Advisor and Postdoctoral Sponsor**

**Graduate Advisor:** S. Tepfer (deceased) University of Oregon  
**Postdoctoral Sponsor:** none

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** L. Chen—Private Co., Washington, DC; G. Hoogenboom—University of Georgia; A. Kuang—Pan American University; R. Larty—USDA, Shelby, MT; S. Pritchard, College of Charleston, SC; R. Shelby—USDA, Pierce, FL  
**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 16

**Number of postdoctoral scholars sponsored:** 2

## Biographical Sketch

### Jan R. Taylor, Ph.D.

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### a. Professional Preparation

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

### b. Appointments

2008-present	Director of Research Programs, Division of Science and Research, West Virginia Higher Education Policy Commission
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) Publications most closely related to proposal

Taylor, J. R. (2002). *Analysis of hazardous materials transportation in the Kanawha Valley* (NICS Technical Publication). Charleston, WV: National Institute for Chemical Studies.

Taylor, J. R. (2001). *Evaluation of model assumptions used for the Alabama CSEPP Program* (Report to U.S. Army, Soldier Biological and Chemical Command, Aberdeen, MD, DAAD13-01-P-0052). Retrieved from [http://www.csepp.army.mil/pub/bibliography/pdf/final\\_report\\_evaluation\\_assumptions.pdf](http://www.csepp.army.mil/pub/bibliography/pdf/final_report_evaluation_assumptions.pdf)

Palmer, D., & Taylor, J. R. (2000). *Protective action decision-making training for emergency responders and planners* (CD-based training course and manual). Charleston, WV: National Institute for Chemical Studies.

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: National Institute for Chemical Studies.

Taylor, J. R., et al. (1999). *Review of chemical accident report – Pennzoil Product Refinery, Rouseville, PA* (NICS Technical Report, EPA Cooperative Agreement). Charleston, WV: National Institute for Chemical Studies.

#### (ii) Other publications

Taylor, J. R. (1994-2003). *West Virginia scorecard: Analysis of toxic release inventory for West Virginia* (Annual publication of the National Institute for Chemical Studies [NICS]). Charleston, WV: National Institute for Chemical Studies.

Hill, P. L., Jr., & Taylor, J. R. (1996). *Transportation of hazardous materials in the Kanawha Valley of West Virginia* (NICS Research Report). Charleston, WV: National Institute for Chemical Studies.

Hill, P. L. Jr., Taylor, J. R., & Ollis, R. R. (1991). *West Virginia discharge reduction scorecard: Pollution reduction and prevention in West Virginia chemical industry* (NICS Research Publication). Charleston, WV: National Institute for Chemical Studies.

**d. Synergistic Activities**

1. Reviewer, USEPA technical documents
2. Member, National Association of State and Tribal Title III Program Officials
3. Project Director, Licensed Remediation Specialist program
4. Member, Technical working group for protective action implementation at chemical stockpile sites
5. Member, Board of Directors, Kanawha-Putnam Emergency Planning Committee

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

Aulick, H.	Marshall University
Batt, C.	Cornell University
Boerio-Goates, J.	Brigham Young University
Graham, J.	Scripps Oceanographic Institute
Guisepppe-Elie, A.	Clemson University
Kerslick, G.	Cornell University
Khonsari, M.	Louisiana State University
Little, T.S.	University of South Carolina
Maher, J.	Marshall University
Peterson, C.	West Virginia University
Salamo, G.	University of Arkansas
Sun, W.	Drexel University

**(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>M.S. Advisor:</b>	Dr. Dan K. Evans	Marshall University
<b>Ph.D. Advisor:</b>	Dr. William J. Mitsch	University of Louisville

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

<b>Thesis Advisor:</b>	David Hight	M.S. student	Marshall University
<b>Postgraduate-Scholar Sponsor:</b>	none		

**Number of graduate students advised:** 1

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Jose Ulises Toledo, Ph. D.

Associate Dean  
Gus R. Douglass Land-Grant Institute  
West Virginia State University  
304 ACEOP Admin. Bldg.  
P.O. Box 1000  
Institute, WV 25112

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**E-mail:** toledoju@wvstateu.edu

### a. Professional Preparation

University of Illinois, Urbana-Champaign	Natural Resources and Environmental Sciences	Ph. D. 2001
University of Illinois, Urbana-Champaign	Business Administration	Ph. D. 1999 (non-thesis)
University of Illinois, Urbana-Champaign	Business Administration	M.B.A. 1997
University of Illinois, Urbana-Champaign	Horticulture	M.S. 1995
Universidad Autónoma, Chapingo, México	Food Science and Agricultural Engineering	B.S. 1991

### b. Appointments

2000-present	Associate Dean, Gus R. Douglass Institute, West Virginia State University, Institute, WV
2007-present	AERS Associate Director (Interim), Gus R. Douglass Institute, West Virginia State University, Institute, WV
2000-present	Director of Business and Finance, Gus R. Douglass Institute, West Virginia State University, Institute, WV
1993-2000	Graduate Teaching Assistant, Departments of Horticulture and Plant Biology, University of Illinois, Urbana-Champaign
1992-2000	Graduate Research Assistant, Department of Horticulture and NRES, University of Illinois, Urbana-Champaign
1997-1997	Environmental and Safety Field Specialist, Ameritech, Inc. Network Services, Cleveland, OH
1996-1996	External Consultant, Federal Reserve Bank of Chicago, Economic Research Branch, Chicago, IL
1987-1991	Student Research Assistant, Department of Food Science and Agricultural Engineering, Universidad Autónoma Chapingo, Chapingo, México

### c. Publications

#### (i) Publications most closely related to proposal

Toledo, J. U. (2002). Genetically modified seeds adoption effects assessment on the Illinois vegetable growers competitive behaviors and the industry's dynamics of competition. (Doctoral dissertation, University of Illinois, Urbana-Champaign, 2002). *Dissertation Abstracts International*, UMI# 3086201.

Toledo, J. U., Smith, M. A. L., Spomer, L. A., & Madhavi, D. (1995, March). Effects of preparation and storage on gelled medium water status and in vitro growth of cranberry (*vaccinium macrocarpon*) and grape (*vitis vinifera* L.) cultures [Abstract]. *In Vitro Biology*, 31(3), 161-251.

Toledo, J. U., Smith, M. A. L., & Spomer, L. A. (1993). Light influence on in vitro anthocyanin production of three cranberry (*vaccinium macrocarpon*) cultivars [Abstract]. *Proceedings of ASHS Conference*.

**d. Synergistic activities**

1. Responsible for establishing a revised intellectual property management policy at WVSU, 2006-present
2. Assisted the University in establishing the Office of Sponsored Programs and responsible for creating research policies at WVSU, 2002-present
3. Coauthor of the first Federal USDA-CSREES Plans of Work (annual and five-year) for the 1890 Facilities Program at WVSU, 2001-present
4. Co-author of the first Federal USDA-CSREES Plans of Work (annual and five-year) for the research and extension programs at WVSU, 2000-present

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

D. Huber	West Virginia State University
O. F. McMeans	West Virginia State University
T. E. Solares	West Virginia State University
E. D. Paramo	Instituto Politecnico Nacional (IPN), México
W. J. Woodrum	West Virginia State University

**(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisors:** M. S.: Mary Ann Lila-Smith, Louis A. Spomer—University of Illinois, Urbana-Champaign; Ph. D.: Anton G. Andress, John B. Masiunas, Mosbah M. Kushad--University of Illinois, Urbana-Champaign

**Postdoctoral Sponsor:** none

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** V. R. Salvador, WVSU and IPN, México

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 1

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Brian L. Antonsen, Ph. D.

Science Building S318  
Marshall University  
1 John Marshall Drive  
Huntington, WV 25755

**Phone:** 304.696.6496

**E-mail:** antonsenb@marshall.edu

### a. Professional Preparation

University of Victoria, Victoria, BC, Canada	Biology	B.Sc.	1992
University of Victoria, Victoria, BC, Canada	Biology	Ph.D.	1999
Georgia State University, Atlanta GA	Neuroscience	1999-2007	Postdoctoral Research

### b. Appointments

2007-present Assistant Professor, Department of Biological Sciences, College of Science, Marshall University

2007-present Adjunct Assistant Professor, Department of Pharmacology, Physiology, and Toxicology, Joan C. Edwards School of Medicine, Marshall University

2003-2007 Adjunct Assistant Professor, Biology Department, Georgia State University

### c. Publications

#### (i) Publications most closely related to proposal

Antonsen, B. L., & Edwards, D. H. (2007). Mechanisms of serotonergic facilitation of a command neuron. *Journal of Neurophysiology*, *98*, 3494-3504. Available at <http://jn.physiology.org/>

Antonsen, B. L., Herberholz J., & Edwards, D. H. (2005). The retrograde spread of synaptic potentials and recruitment of presynaptic inputs. *Journal of Neuroscience*, *25*, 3086-3094. Available at <http://www.jneurosci.org/>

Herberholz, J., Antonsen, B. L., & Edwards, D. H. (2002). A lateral excitatory network in the escape circuit of crayfish. *Journal of Neuroscience*, *22*, 9078-9085. Available at <http://www.jneurosci.org/>

Antonsen, B. L., & Edwards, D. H. (2003). Differential dye-coupling reveals the lateral giant escape circuit in crayfish. *Journal of Comparative Neurology*, *466*, 1-13. Available at <http://www3.interscience.wiley.com/journal/31248/home>

Spitzer, N., Antonsen, B. L., & Edwards, D. H. (2005). Immunocytochemical mapping and quantification of expression of a putative type 1 serotonin receptor in the crayfish nervous system. *Journal of Comparative Neurology*, *484*, 261-282. Available at <http://www3.interscience.wiley.com/journal/31248/home>

#### (ii) Other Publications

Edwards, D. H., Yeh, S.-R., Musolf, B. E., Antonsen, B. L., & Krasne, F. B. (2002). Metamodulation of the crayfish escape circuit. *Brain, Behavior, & Evolution*, *60*, 360-369. Available at <http://www.karger.com/bbe>

Musolf, B. E., Spitzer, N., Antonsen, B. L., & Edwards, D. H. (in press). Serotonergic modulation of crayfish hindgut activities. *Biological Bulletin*. Available at <http://www.biolbull.org>

Antonsen, B. L., & Paul, D. H. 2001. Serotonergic and octopaminergic systems in the squat lobster *Munida quadrispina* (Anomura, Galatheidae). *Journal of Comparative Neurology*, *439*, 450-468. Available at <http://www3.interscience.wiley.com/journal/31248/home>

Antonsen, B. L., & Paul, D. H. (1997). Serotonin and octopamine elicit stereotypical agonistic behaviors in the squat lobster *Munida quadrispina* (Anomura, Galatheidae). *Journal of Comparative Physiology A*, 181, 501-510.

Antonsen, B. L., & Paul, D. H. (2000). The leg depressor and levator muscles in the squat lobster *Munida quadrispina* (Galatheidae) and the crayfish *Procambarus clarkii* (Astacidae) have multiple heads with potentially different functions. *Brain, Behavior, & Evolution*, 56, 63-85. Available at <http://www.karger.com/bbe>

#### **d. Synergistic Activities**

1. Co-Director of the Marshall University Brain Expo, the initial effort to bring Brain Awareness Week activities to Western West Virginia, 2009 -
2. Development of a new two-part graduate course on scientific survival skills for Marshall University Department of Biological Sciences
3. Commitment to underrepresented participation in STEM education and research; I believe in providing opportunities, mentorship, and support to people from underrepresented groups in higher education and research.
4. Instructor for the Behavioral Research Advancements in Neuroscience Program, Center for Behavioral Neuroscience at Spelman College in Atlanta, GA, 2007
5. Crayfish at Zoo Atlanta—I was involved in a joint project between the Center for Behavioral Neuroscience and Zoo Atlanta, the goal of which is to educate zoo visitors about animal behavior and the role of nervous systems in shaping those behaviors, 2003-2007.

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Deborah Baro	Georgia State University
Saeid Belkasim	Georgia State University
Donald Edwards	Georgia State University
Jens Herberholz	University of Maryland
Karen Mesce	University of Minnesota
Dorothy Paul	University of Victoria

##### **(ii) Graduate and Postdoctoral Sponsors**

**Graduate Advisor:** Dorothy Paul                      University of Victoria, Canada  
**Postdoctoral Sponsor:** Donald Edwards                      Georgia State University

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Joshua Titlow                      Marshall University  
**Postgraduate-Scholar Sponsor:** none

**Total number of graduate students advised:** 1

**Total number of postdoctoral scholars sponsored:** none



## Biographical Sketch

### Eric R. Blough, Ph. D.

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Marshall University  
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### a. Professional Preparation

Michigan Technological University	Biology	B.S. 1990
Southern Illinois University	Exercise Physiology	M.S. 1992
The Ohio State University	Exercise Physiology	Ph.D. 1997
University of Illinois-Chicago	Physiology/Biophysics	1999
		Postdoctoral Research

### b. Appointments

2008-present	Associate Member, Center for Muscle Biology, University of Kentucky,
2006-present	Marshall University, Associate Professor
2006-present	Member, WV Nano
2006-present	Adjunct Assistant Professor of Exercise Physiology, Marshall University
2006-present	Graduate Faculty Member, West Virginia State University, Biotechnology Program
2005-present	Research Director, Marshall University, Cardioscience Research Group, Joan C. Edwards School of Medicine
2005-present	Marshall University, Director Flow Cytometry Facility
2003-present	Michigan Technological University, Adjunct Assistant Professor of Biomedical Engineering
2003 to 2006	Marshall University, Assistant Professor

### c. Publications

#### (i) Publications most closely related to proposal

Takatsuki, H., Kolli, M., Rice, K. M., Day, S. B., Asano, S., Blough, E. R., et al. (in press). Assembly and function of myosin II on ultraviolet/ozone patterned trimethylchlorosilane substrates. *Journal of Bionanotechnology*.

#### (ii) Other publications

Katta, A., Karkala, S., Preston, D. L., Yokochi, E., Rice, K. M., Blough, E. R., et al. (in press). Diabetes alters high force muscle contraction induced mitogen activated protein kinase (MAPK) activation in the rat soleus and plantaris. *Experimental Diabetes Research*.

Rice, K. M., Uddemarr, S., Mylabathula, D. B., Harris, R. T., Wright, G. L., & Blough, E. R. (2008, February). PGF(2alpha)-associated vascular smooth muscle hypertrophy is ROS dependent and involves the activation of mTOR, p70(S6k), and PTEN. *Prostaglandins & Other Lipid Mediators*, 85(1-2), 49-57.

Asano, S., Rice, K. M., Kakarla, S., Katta, A., Desai, D. H., Blough, E.R., et al. (2007). Aging influences multiple indices of oxidative stress in the heart of the Fischer 344/NNia x Brown Norway/BiNia rat. *Redox Report*, 12(4), 167-180.

Rice, K. M., Preston, D. L., Neff, D., Norton, N., & Blough, E. R. (2006, November). Age-related dystrophin glycoprotein complex structure and function in the rat extensor digitorum longus and soleus muscle. *Journals of Gerontology A: Biological Sciences and Medical Sciences*, 61(11): 1119-1129.

Rice, K. M., & Blough, E. R. (2006, May 3). Sarcopenia-related apoptosis is regulated differently in fast- and slow-twitch muscles of the aging F344/NxBN rat model. *Mechanisms of Ageing and Development*, 127(7), 635-646.

**d. Synergistic Activities**

1. Research Director, Cardiovascular Research Consortium, Joan C. Edwards, School of Medicine
2. Science fair judge, West Virginia State Science and Engineering Fair, 2004-2006
3. Marshall undergraduate SURE mentor program; currently advise two female students
4. Co-organizer of the Marshall University symposium "Frontiers in Life Science: from DNA to Phenotypes," Huntington, WV, March 29, 2004

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

Tammy Haut Donahue	Michigan Technological University
Robert Harris	West Virginia State University
Mike Norton	Marshall University
Elmer Price	Marshall University
Peter Reiser	The Ohio State University
Ernest Walker	Marshall SOM
Gary Wright	Marshall University SOM

**(ii) Graduate and Postdoctoral Advisors**

<b>Graduate Advisor:</b>	Jon Linderman	The Ohio State University
<b>Postgraduate Advisor:</b>	Karyn Esser	University of Kentucky

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor**

Brandon Armstrong	Marshall University
Bob Efiler	Michigan Technical University
Robert Putt	Michigan Technical University
Kevin Rice	Marshall University
Ajay Sundaram	Marshall University
Sreevani Uddemaari	Marshall University
Zihao Wang	Marshall University
Elli Yokochi	Marshall University

**Postgraduate-Scholar Sponsor**

Hideyo Takatsuki	Gunma University
Miaozong Wu	VTU

**Number of graduate students advised: 8**

**Number of postdoctoral scholars sponsored: 2**

## Biographical Sketch

### Xian-An Cao, Ph. D.

ESB 729  
Department of Computer Science  
and Electrical Engineering  
P.O. Box 6109  
West Virginia University  
Morgantown, WV 26506

Phone: 304.293.9684  
E-mail: xacao@mail.wvu.edu

### a. Professional Preparation

University of Florida	Materials Science and Engineering	Ph.D. 2000
Fudan University, China	Condensed Matter Physics	M. S. 1997
Fudan University, China	Physics	B. S. 1995

### b. Appointments

2006-present	Assistant Professor, Department of Computer Science and Electrical Engineering, West Virginia University
2001-2006	Research Scientist, GE Global Research Center, NY
2000-2001	R&D Engineer, AXT Optoelectronics, CA

### c. Publications

#### (i) Publications most closely related to proposal

Cao, X. A., Abernathy, C. R., Singh, R. K., Pearton, S. J., Fu, M., Sarvepalli, V., et al. (1998). Ultrahigh Si+ implant activation efficiency in GaN using a high-temperature rapid thermal process system. *Applied Physics Letters*, 73, 229.

Cao, X. A., Pearton, S. J., Dang, G. T., Zhang, A. P., Ren, F., Shul, R. J., et al. (1999). Electrical effects of plasma damage in p-GaN. *Applied Physics Letters*, 75, 2569.

Cao, X. A., Ren, F., & Pearton, S. J. (2000). Advanced Processing of GaN for electronic devices. *Critical Reviews in Solid State and Materials Sciences*, 25, 279.

Cao, X. A., LeBoeuf, S. F., Rowland, L., Yan, C. H., & Liu, H. (2003). Temperature-dependent emission intensity and energy shift in InGaN/GaN multiple-quantum-well light-emitting diodes. *Applied Physics Letters*, 83, 3614.

Cao, X. A., LeBoeuf, S. F., D'Evelyn, M. P., Arthur, S. D., Kretchmer, J., Yan, C. H., et al. (2004). Blue and near-ultraviolet light-emitting diodes on free-standing GaN substrates. *Applied Physics Letters*, 84, 4313.

#### (ii) Other publications

Cao, X. A., Teetsov, J. M., D'Evelyn, M. P., Merfeld, D. W., & Yan, C. H. (2004). Electrical characteristics of InGaN/GaN light-emitting diodes grown on GaN and sapphire substrates. *Applied Physics Letters*, 85, 7.

Cao, X. A., & Arthur, S. D. (2004). High-power and reliable operation of vertical light-emitting diodes on bulk GaN. *Applied Physics Letters*, 85, 3971.

Cao, X. A., Lu, H., LeBoeuf, S. F., Cowen, C., Arthur, S. D., & Wang, W. (2005). Growth and characterization of GaN PiN rectifiers on free-standing GaN. *Applied Physics Letters*, 87, No. 053503.

Cao, X. A., Yang, Y., & Guo, H. (2008). On the origin of efficiency roll-off in InGaN-based light-emitting diodes. *Journal of Applied Physics*, 104, No. 093108

Yang, Y., Cao, X. A., & Yan, C. H. (2009). Rapid efficiency roll-off in high-quality green light-emitting diodes on free-standing GaN substrates. *Applied Physics Letters*, 94, No. 041117.

### d. Synergistic Activities

1. Associate editor, *Advances in Optoelectronics*, 2006-
2. Editorial board member, *Contemporary Engineering Sciences*, 2007-

3. Editorial board member, *The Open Crystallography Journal*, 2007-
4. Member, Materials Research Society (MRS), International Society for Optical Engineering (SPIE), Electrochemical Society (ECS)
5. Member, WVNano Initiative

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

P. Hong	GE Research Center
S. F. Leboeuf	Valencell, Inc.
L. Rowland	Aymont Technology
A. Sirkin	TDI, Inc.
C. H. Yan	Invenlux Corp.
J. P. Zhang	Sensor Electronic Technology

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Master's Advisor:</b>	Prof. X.Y. Hou	Department of Physics, Fudan University, China
<b>Ph.D. Advisor:</b>	Prof. S. J. Pearton	Department of Materials Science and Engineering, University of Florida

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** M. S.: Satish Yeldandi, Ahad Ali Syed, Hong Guo, Henry Andagana, Srinitya Musunuru—WVU; Ph. D.: Yi Yang, Yiqing Zhang—WVU  
**Postgraduate-Scholar Sponsor:** Gaoyu Zhang—WVU

**Number of graduate students advised:** 7

**Number of postdoctoral scholars sponsored:** 1

## Biographical Sketch

### Richard Lloyd Carroll, Ph. D.

Assistant Professor, Chemistry  
P.O. Box 6045  
West Virginia University  
Morgantown, WV 26506

**Phone:** 304.293.3435 x 6443

**E-mail:** lloyd.carroll@mail.wvu.edu

### a. Professional Preparation

North Carolina State University  
North Carolina State University  
University of North Carolina-  
Chapel Hill

Science Education  
Chemistry (Inorganic)  
Department of Physics  
and Astronomy

B. S. 1991  
Ph. D. 2001  
2001-2005  
Postdoctoral Research

### b. Appointments

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

### c. Publications

#### (i) Publications most closely related to the proposal

Asokan, S. B., Jawerth, L. M., Carroll, R. L., Cheney, R. E., Washburn, S., & Superfine, R. (2002). Two-dimensional manipulation and orientation of actin-myosin systems with dielectrophoresis. *Nano Letters*, 3, 431-437.

Jones, B. F., Wall, M. E., Carroll, R. L., Washburn, S., & Banes, A. J. (2005). Ligament cells stretch-adapted on a microgrooved substrate increase intercellular communication in response to a mechanical stimulus. *Journal of Biomechanics*, 38, 1653-1664.

Evans, B. A., Shields, A. R., Carroll, R. L., Washburn S., Falvo, M. R., & Superfine, R. (2007). Magnetically actuated nanorod arrays as biomimetic cilia. *Nano Letters*, 7, 1428-1434.

Lee, Y., Carroll, R. L., Holland, L., & Famouri, P. (2008). Biomolecular shuttles under dielectrophoretic forces. *Proceedings of 8th IEEE Conference on Nanotechnology*, 667-672.

Edwards, B. F., Timperman, A., Carroll, R. L., Jo, K., Mease, J., & Schiffbauer, J. (2009). Traveling-wave electrophoresis for microfluidic separations. *Physical Review Letters*, 102, No. 76103-1-4.

#### (ii) Other publications

Gorman, C. B., Carroll, R. L., He, Y. F., Tian, F., & Fuierer, R. (2000). Chemically well-defined lithography using self-assembled monolayers and scanning tunneling microscopy in nonpolar organothiol solutions. *Langmuir*, 16, 6312-6316.

Gorman, C. B., Carroll, R. L., & Fuierer, R. (2001). Negative differential resistance in patterned, electroactive self-assembled monolayers. *Langmuir*, 17, 6923-6930.

Gorman, C. B., He, Y. F., & Carroll, R. L. (2001). The influence of head group on the structure of self-assembled monolayers as viewed by scanning tunneling microscopy. *Langmuir*, 17, 5324-5328.

Sauthier, M. L., Carroll, R. L., Gorman, C. B., & Franzen, S. (2002). Nanoparticle layers assembled through DNA hybridization: Characterization and optimization. *Langmuir*, 18, 1825-1830.

Carroll, R. L., & Gorman, C. B. (2002). The genesis of molecular electronics. *Angewandte Chemie International Edition*, 41, 4378-4400.

**d. Synergistic Activities**

1. Member, WVNano Initiative, 2005-present
2. Fellow, Institute for Advanced Energy Studies—an NETL (DoE)-university collaboration
3. Referee, *Biophysical Journal*, *Chemistry of Materials*, *Journal of Bionanotechnology*
4. Proposal reviewer, NSF (DMI, ASC), DoE, WVU Faculty Senate Grant
5. Mentor, WVU (2005-present)—5 REU students, 9 WVNano SURE students, 3 WVNano Bridge graduate students; UNC (2001-2005)—10 undergraduate students (under-represented minorities) through the SPGRE, SMART, and REU programs

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

S. B. Asokan	University of North Carolina-Chapel Hill
A. J. Barnes	University of North Carolina-Chapel Hill
S. Bell	West Virginia University
R. E. Cheney	University of North Carolina-Chapel Hill
B. Edwards	West Virginia University
M. Falvo	University of North Carolina-Chapel Hill
P. Famouri	West Virginia University
P. Gannett	West Virginia University
L. Holland	West Virginia University
B. F. Jones	University of North Carolina-Chapel Hill
D. Korakakis	West Virginia University
D. Lederman	West Virginia University
A. Mount	Clemson University
M. Seehra	West Virginia University
K. Showalter	West Virginia University
R. Superfine	University of North Carolina-Chapel Hill
A. Timperman	West Virginia University
S. Urazhdin	West Virginia University
S. Washburn	University of North Carolina-Chapel Hill
N. Wu	West Virginia University

**(ii) Graduate Advisor and Postdoctoral Sponsor**

<b>Graduate Advisor:</b> C. B. Gorman	North Carolina State University
<b>Postdoctoral Sponsor:</b> R. Superfine	University of North Carolina-Chapel Hill

**(ii) Thesis Advisor and Postgraduate-Scholar Sponsor**

<b>Thesis Advisor:</b> Mikala Shremshock, Usha Veeramachaneni, Shengrong Ye, Sri Lakshmi Yedlapalli, Yuan Li—West Virginia University
<b>Postgraduate-Scholar Sponsor:</b> Victor Abdel-Sayed, Young Ho Kim—West Virginia University

**Number of graduate students advised: 5**

**Number of postdoctoral scholars sponsored: 5**

## Biographical Sketch

### Tina J. Cartwright, Ph. D.

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Marshall University  
1 John Marshall Drive  
Huntington, WV 25755

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**Fax:** 304.696.2880

### a. Professional Preparation

West Virginia University  
Florida State University  
Florida State University

Geography  
Meteorology  
Meteorology

B. A. 1994  
M. S. 1997  
Ph. D. 2004

### b. Appointments

2009-present	Sara Denman Faces of Appalachia Fellowship, Marshall University
2007-present	Assistant Professor, Marshall University
2006-2007	MU ADVANCE Program Director, Marshall University
2005-2006	West Virginia State Climatologist
2003-2005	Assistant Professor, West Virginia State Community and Technical College, Institute, WV
2000-2003	Instructor, West Virginia State University, Institute, WV
1998-2000	Assistant Research Staff, Lincoln Laboratories, Lexington, MA
1994-1998	Research Assistant, Florida State University

### c. Publications

#### (i) Publications most closely related to proposal

Cartwright, T., & Krishnamurti, T.N. (2007). Warm season mesoscale superensemble precipitation forecasts. *Weather and Forecasting*, 22, 873-886.

Cartwright, T., & Ray, P. S. (1998). Radar derived estimates of latent heating in the subtropics. *Monthly Weather Review*, 125, 726-742.

Krishnamurti, T. N., Wagner, C. P., Cartwright, T.J., & Oosterhof, D. (1997). Wave trains excited by cross-equatorial passage of the monsoon annual cycle. *Monthly Weather Review*, 125, 2709-2715.

#### d. Synergistic Activities

1. Guest lecturer, University of Costa Rica, San Jose, CR, 2008
2. NSF panel reviewer for programs—ITEST (Innovative Technology Experiences for Students and Teachers); OEDG (Opportunities for Enhancing Diversity in Geosciences), 2008
3. Co-principal investigator, NSF Appalachian Math Science Partnership in WV (\$2M), 2008
4. Outstanding young West Virginia researcher, EPSCoR, 2007
5. Principal investigator, 2 NSF programs: "COMmunities Educating Tomorrow's Scientists" and "Integrated Design for Geoscience Education: Upward Bound in WV," (\$950K), 2007

### e. Collaborators and Other Affiliations

#### (i) Collaborators

Janet Amos	Marshall University Community and Technical College
Steve Beckelhimer	Marshall University
Tom Berlin	ABC
Michael Corrigan	Marshall University
Todd Ensign	NASA
Steven Fleegel	West Virginia State Community and Technical College
B. E. Forman	Lincoln Laboratories

R. G. Hallowell	Lincoln Laboratories
Katherine Harper	West Virginia State University
Marcia Harrison	Marshall University
Deb Hemler	Florida State University
Ken Martis	West Virginia University
Stan Maynard	Marshall University
M. P. Moore	Lincoln Laboratories
Tom Repine	WV Geological Survey
Alan Rezek	NWS
K. E. Theriault	Lincoln Laboratories
C. P. Wagner	SAHM
Tim Warner	West Virginia University
M. M. Wolfson	Lincoln Laboratories

**(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisor:** T. N. Krishnamurti, Peter S. Ray—Florida State University

**Postdoctoral Sponsor:** none

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Connie Howell, Suzanne Smith, Miranda Hogsett, Carrie Adams—Marshall University

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 4

**Number of postdoctoral scholars sponsored:** none



## Biographical Sketch

**Jeffrey S. Carver, Ed. D.**  
West Virginia University  
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and Instruction/Literacy Studies  
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**Phone:** 304-293-3841  
**E-mail:** jeffrey.carver@mail.wvu.edu  
**Fax:** 304-293-3802

### a. Professional Preparation

Illinois State University	Chemistry (with teacher certification)	B.S. 1993
Northern Illinois University	Chemistry (organic)	M.S. 1998
Illinois State University	Curriculum and Instruction	Ed. D. 2006

### b. Appointments

2008-present	Assistant Professor of Secondary Science Education, Department of Curriculum and Instruction/Literacy Studies, West Virginia University
2001-2008	Professor of Chemistry, Division of Natural Sciences and Business, Illinois Valley Community College
1996-2001	Laboratory Instructor, Division of Natural Sciences and Mathematics, Illinois Valley Community College
1995-1996	Chemistry and Physics Teacher, Minooka Community High School
1980-1982	Chemistry and Physics Teacher, Sycamore High School

### c. Publications

#### (i) Publications most closely related to proposal

Richards-Babb, M., Bishoff, J., Carver, J. S., Fisher, K., & Robertson-Honecker, J. (in press). Keeping it safe: Chemical safety in the high school laboratory. *Journal of Chemical Health & Safety*.

Mumba, F. K., Chabalengula, V. M., Wilson, E., Carver, J. S., & Hunter, W. J. F. (2009). Resident scientists' conceptions of science teaching. *Problems of Education in the 21st Century*, 11(11), 129-138.

Mumba, F. K., Carver, J. S., Chabalengula, V. M., & Hunter, W. J. F. (2009). Junior chemists' understanding of the nature of scientific theories and laws. *Journal of Baltic Science Education*, 8(1), 15-21.

Carver, J. S. (2006). *Instructional decision-making of high school science teachers*. (Doctoral Dissertation, Illinois State University, 2006). *Dissertation Abstracts International*, 67(09A), 3277.

Short, B. J., Carver, J. S., Hunter, W. J. F., & Young, J. R. (2001). Moments in Constructivism: How does accepting our failures allow us to examine our teaching? *Chemical Educator*, 6, 277-287.

#### (ii) Other publications

Brown, K. E., Micklos, A., Carver, J. S., & Hunter, W. J. F., (2004). A teaching plan for introducing gas properties. *The Chemical Educator*, 9, 4.

Kevill, D., & Carver, J. S. (2004). Rate and product studies with dimethyl phosphorochloridate and phosphorochloridothionate under solvolytic conditions. *Organic and Biomolecular Chemistry Articles*, 2, 2040-2043.

Hunter, W. J. F., Carver, J. S., Marsiglio, B. P., Pennekamp, R., Jeans, K. M., & Shewfelt, E. (2001). Online chemistry help service in non-majors general chemistry. *Conferences of Chemistry: Fall 2001 Online Chemical Education Conference on Online Teaching Methods*. Available at <http://www.chedccce.org/confchem/2001/c/index.html>

#### **d. Synergistic Activities**

1. Co-PI: TEACH-WV—NSF Robert Noyce Scholarship, 2009-2013
2. Program evaluator: provide evaluation consulting on a professional development master's degree program in chemistry education (funded through the Illinois Math and Science Partnership program), 2007-2009
3. Program evaluator: provide evaluation consulting on NSF Undergraduate Research Collaborative grant (URC), 2009-2012
4. Program evaluator: provide evaluation consulting on a professional development program for in-service teachers in earth science (Illinois EarthScope project funded through the Illinois Math and Science Partnership program), 2009-2011
5. Curriculum development and implementation: design and implement standards-based, constructivist oriented inquiry-based teacher professional development opportunities for practicing science teachers in Illinois, 2001-2008

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Morna Brothers	Harold Washington College, IL
Vivian Chabalengula	Southern Illinois University, Carbondale
Thomas Dowd	Harold Washington College, IL
Kate Edler	Illinois State University
Todd Ensign	NASA IV&V ERC, Fairmont, WV
Gregory Ferrence	Illinois State University
Kimberly Fisher	Rhodes College, TN
Yvonne Harris	William Rainy Harper College, IL
Thomas B. Higgins	Harold Washington College, IL
Roger House	William Rainy Harper College, IL
Frackson Mumba	Southern Illinois University
Stephanie Persson	Illinois State University
Cathy Toll	Toll and Associates, WI
Erin Wilson	Southern Illinois University

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

**Master's Advisor:** Dennis Kevill (retired) Northern Illinois University

**Doctoral Advisors:** William Hunter Illinois State University

Dent Rhodes (retired) Illinois State University

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Razan Snari West Virginia University

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 1

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Sean Anthony Collins, Ph. D.

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West Virginia State University  
Institute, WV 25112

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### a. Professional Preparation

St. Lawrence University, Canton, NY	Biology	B. S. 1992
University of Illinois, Urbana–Champaign	Entomology	M. S. 1996
University of Illinois, Urbana–Champaign	Entomology	Ph. D. 2003

### b. Appointments

2005-present	Assistant Professor, Department of Biology, West Virginia State University
2004-2005	Visiting Scientist/Scholar, University of Illinois, Urbana-Champaign
2003-2005	Postdoctoral Research Associate, Department of Evolution, Ecology, and Organismal Biology, The Ohio State University
2001	Visiting Scientist/Scholar, Imperial College at Silwood Park, Ascot, UK
2001-2003	Graduate Research Assistant, Department of Entomology, University of Illinois, Urbana-Champaign
2000	Visiting Scientist/Scholar, Imperial College at Silwood Park, Ascot, UK
1997-2000	Graduate Teaching Assistant, Department of Entomology, University of Illinois, Urbana-Champaign
1993-1996	Graduate Research Fellow, Department of Entomology, University of Illinois, Urbana-Champaign

### c. Publications

#### (i) Publication most closely related to proposal

Collins, S. A., Conner, J. K., & Robinson, G. E. (1997). Foraging behavior of honey bees (Hymenoptera: Apidae) on *Brassica nigra* and *B. rapa* grown under simulated ambient and enhanced UV-B radiation. *Annals of the Entomological Society of America*, 90(1), 102-107.

#### d. Synergistic activities

1. Co-principal investigator (with Ms. Krystal Smith), Mobilizing Against Threats to Community Health (MATCH): Identifying threats to community health to residents of the Kanawha Valley, WV, \$20,000, 2008; co-principal investigator (PIs: Padma Nimmakayala, U. Reddy), USDA Capacity Building Grant (CSREES): BAC to genes, \$200,000, 2007; co-principal investigator (Co-PIs: U. Reddy, T. Ruhnke, D. Huber, G. Hankins), USDA Capacity Building Grant (CSREES): Unifying cross disciplinary genomic platforms using model genetic organisms for teaching biotechnology, \$299,897, 2006
2. Recipient, WVSU Faculty Research minigrant: Completing a phylogeography for the introduced social wasp, *Vespa crabro*, \$1,500, 2009; recipient, National Aeronautics and Space Administration minigrant: Identification of microsatellites for the wasp, *Vespa crabro*, \$2,000, 2007
3. Collaborated on the development of and sole instructor for one of the foundation classes in the new biology curriculum at WVSU, Biology 121 (Biodiversity)
4. Oversaw, as part of the SURE program, two research projects: (1) a survey of the ant species of Kanawha County; (2) a study of the effects of various waters of the state on the growth and survival of frog tadpoles
5. Academic coordinator for the Health Science and Technology Academy forensics experience; designed a crime scene for the students to investigate and solve

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

Stewart H. Berlocher	University of Illinois at Urbana-Champaign
Padma Nimmakayala	West Virginia State University
Umesh Reddy	West Virginia State University
Steven Rissing	The Ohio State University

**(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>M. S. Advisor:</b> Dr. Gene E. Robinson	University of Illinois at Urbana-Champaign
<b>Ph. D. Advisor:</b> Dr. Stewart H. Berlocher	University of Illinois at Urbana-Champaign
<b>Postdoctoral Advisor:</b> Dr. Steven Rissing	The Ohio State University

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsors**

<b>Thesis Advisor:</b> Tiffani Wood	M. S. student	West Virginia State University
<b>Postgraduate-Scholar Sponsors:</b>	none	

**Number of graduate students advised:** 1

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

**Jeremy M. Dawson, Ph. D.**  
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West Virginia University  
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### a. Professional Preparation

West Virginia University	Electrical Engineering	B. S. 1997
West Virginia University	Electrical Engineering	M. S. 1999
West Virginia University	Electrical Engineering	Ph. D. 2002

### b. Appointments

2007-present	Research Assistant Professor, Lane Department of Computer Science and Electrical Engineering, West Virginia University
2003-2007	Materials Science Branch Supervisor/Scientist, ISR, Inc./MVHTCF
2002-2003	Postdoctoral Researcher, Lane Department of Computer Science and Electrical Engineering, West Virginia University
1997-2002	Graduate Research Assistant, Lane Department of Computer Science and Electrical Engineering, West Virginia University

### c. Publications

#### (i) Publications most closely related to proposal

Yalamanchili, H., Hornak, L. A., Korakakis, D., & Dawson, J. M. (2009). Bandgap tuning of photonic crystals on III-V nitride thin films. *Proceedings of PSIE, 7402*, 740212.

Hamza, B. M., Yalamanchili, H., Andagana, H., Cao, X., Hornak, L. A., Dawson, J. M., et al. (2008). Top-down approach to the fabrication of GaN-based photonic crystal biosensor. *Proceedings of Fall 2008 MRS Meeting*, 1133E. Available at [http://www.mrs.org/s\\_mrs/sec\\_subscribe.asp?CID=16708&DID=246763&action=detail](http://www.mrs.org/s_mrs/sec_subscribe.asp?CID=16708&DID=246763&action=detail)

Tompkins, R. P., Dawson, J. M., Hornak, L. A., & Myers, T. H. (2008). Optofluidic photonic crystals for biomolecular fluorescence enhancement: a bottom-up approach for fabricating GaN-based biosensors. *Proceedings of PSIE, 7056*, 70560J.

Tompkins, R. P., Dawson, J. M., Hornak, L. A., & Myers, T. H. (2008). Polarity Inverted GaN for photonic crystal biosensor applications. *ECS Transactions*, 16, 213.

Dawson, J. M., Nightingale, J. R., Tompkins, R. P., Cao, X., Myers, T. H., Hornak, L. A., et al. (2008). GaN photonic crystal-based, enhanced fluorescence biomolecule detection system. *Proceedings of the MRS, 1040*. Available at [http://www.mrs.org/s\\_mrs/sec\\_subscribe.asp?CID=11340&DID=208942&action=detail](http://www.mrs.org/s_mrs/sec_subscribe.asp?CID=11340&DID=208942&action=detail)

#### (ii) Other Publications

Izadian, A., Dawson, J., & Famouri, P. (2008). Input-output synchronization for bias drift reduction of MEMS gyroscopes. *Proceedings of the 2008 IEEE American Controls Conference*, 3751-3754

Dawson, J. M., Harrison, M. A. F., Maxey, C. A., McCormick, W. B., & Hornak, L. A. (2006, February). Utilizing chaotic excitation of microelectromechanical systems (MEMS) for micro structure fault detection. *Proceedings of SPIE, 6172*, 617219-1-12.

Park, J., Wang, L., Dawson, J. M., Hornak, L. A., & Famouri, P. (2005, June). Sliding mode-based microstructure torque and force estimation using MEMS optical monitoring. *IEEE Sensors Journal*, 5(3) 546-552.

Wang, L., Dawson, J. M., Hornak, L. A., & Famouri, P. (2004, April). Real-time high-frequency closed-loop translational control of a microelectromechanical systems (MEMS) lateral comb resonator. *IEEE Transactions, AES*, 40(2), 567-575.

**d. Synergistic Activities**

1. Paper reviewer for IEEE ACC 2005, *Physics Review Letters*
2. Staff lecturer for West Virginia University Fall Semester 2004, 2005, 2008; Spring Semester 2009
3. Awarded the WVU Lane Department of Computer Science and Electrical Engineering Lane Fellowship, Fall 2001
4. Winner, first place, in the 2000 Sigma Xi research competition for MEMS optical monitoring and control research (in collaboration with Limin Wang and Jingdong Chen of the WVU CSEE Electromechanical Systems [EMS] Lab)
5. Recipient, research grant—Integrated Optofluidic Photonic Crystal (PhC) Resonant Fluorescence Enhancement Biosensors—proposal funded by DIA/NCMR; funding level: \$500,465 over 3 years

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

Michael Goodman	WVHTCF
Mary Ann Harrison	WVHTCF
Lawrence Hornak	West Virginia University
Thomas Myers	Texas State University
Tom Owens	WVHTCF
Louis Pecora	Naval Research Laboratories
Aaron Timperman	West Virginia University
Michael Webb	Lockheed Martin

**(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Thesis Advisor:</b>	Dr. Lawrence Hornak	West Virginia University
<b>Postdoctoral Sponsor:</b>	Dr. Parviz Famouri	West Virginia University

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** none  
**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 3

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Cerasela Zoica Dinu, Ph. D.

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### a. Professional Preparation

University of Bucharest, Bucharest, Romania  
University of Bucharest, Bucharest, Romania  
Max Planck Institute of Molecular Cell Biology  
and Genetics & TU Dresden, Dresden,  
Germany

Physics  
Biophysics  
Biology

B. S. 2000  
M. S. 2002  
Ph. D. 2006

### b. Appointments

2009-present           Assistant Professor, Department of Chemical Engineering, West Virginia  
University  
2006-2009            Postdoctoral Research Associate, Rensselaer Polytechnic Institute

### c. Publications

#### (i) Publications most closely related to proposal

Dinu, C. Z., Zhu, G., Bale, S. S., Anand, G., Reeder, P. J., Sanford, K., et al. (in press). Enzyme-based nanoscale composites for use as active decontamination surfaces. *Advanced Functional Materials*.

Dinu, C. Z., Bale, S. S., Chrisey, D. B., & Dordick, J. S. (2009). Manipulation of individual carbon nanotube by reconstructing the intracellular transport of a living cell. *Advanced Materials*, 21(10-11), 1182-1186.

Dinu, C. Z., Bale, S. S., Zhu, G., & Dordick, J. S. (2009). Tubulin encapsulation of carbon nanotubes into functional hybrid assemblies. *Small*, 5(3), 310-315.

Dinu, C. Z., Chrisey, D. B., Diez, S., & Howard, J. (2007). Cellular motors for molecular manufacturing. *Anatomical Record*, 290(10), 1203-1212.

Dinu, C. Z., Opitz, J., Pompe, W., Howard, J., Mertig, M., & Diez, S. (2006). Parallel manipulation of bifunctional DNA-molecules on structured surfaces by using kinesin-driven microtubules. *Small*, 2(8-9), 1090-1098.

#### (ii) Other publications

Dinu, C. Z., Chakrabarty, T., Mauer, C., Lunsford, E., Plewa, J.S., Dordick, J. S., et al. (in press). Optical manipulation of microtubules for directed biomolecule assembly. *Soft Matters*.

Dinu, C. Z., Dinca, V., Howard, J., & Chrisey, D. B. (2007). Printing technologies for fabrication of bioactive and regular microarrays of streptavidin. *Applied Surface Science*, 253, 8119–8124.

Diez, S., Reuther, C., Dinu, C., Seidel, R., Mertig, M., Pompe, W., et al. (2003). Stretching and transporting DNA molecules using motor proteins. *NanoLetters*, 3(9), 1251-1254.

Dinu, C. Z., Dinca, V. C., Soare, S., Moldovan, A., Smarandache, D., & Scarisoareanu, N., et al. (2007). Monitoring nitinol alloy surface reactions for biofouling studies. *Applied Surface Science*, 253, 7719–7723.

Doraiswamy, A., Dinu, C., Cristescu, R., Messersmith, P. B., Chisholm, B. J., Stafslie, S., et al. (2007). Matrix-assisted pulsed-laser evaporation of DOPA-modified poly(ethylene glycol) thin films. *Journal of Adhesion Science and Technology*, 21(3-4), 287-299.

#### **d. Synergistic Activities**

1. Assisted in the development of curricular materials and pedagogical methods for a new course ("Processing Biomaterials") in the Department of Materials Science and Engineering at Rensselaer Polytechnic Institute
2. Presented my research at national and international conferences; received Young Scientist Award at the EMRS 2006 Spring Meeting, France; Keynote Speaker Award at the Bioprinting and Biopatterning 2<sup>nd</sup> Workshop, Charleston, SC, 2005; R13 NIH Travel and Conference award, Galveston, TX, 2009
3. Supervised graduate (four Ph.D.'s, one master student), undergraduate research (three), and postdocs (two) at both Rensselaer Polytechnic Institute and NILPRP, Bucharest, Romania
4. Serve the scientific community as a regular reviewer for *Small*, *Langmuir*, *Biotechnology and Bioengineering*, *Biomaterials*, *Biomedical Materials*, *Applied Surface Science*, and *Applied Biochemistry and Biotechnology*
5. Professionally affiliated with American Chemical Society, The American Institute of Chemical Engineers, European Materials Research Society, Society of Photo-Optical Instrumentation Engineers, and Biophysical Society

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators**

Douglas B. Chrisey	Rensselaer Polytechnic Institute
Jonathan Dordick	Rensselaer Polytechnic Institute

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisor:** Jonathan Howard Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany

**Postdoctoral Sponsors:** Genencor International  
Rensselaer Polytechnic Institute/National Science Foundation

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** none

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** none

**Number of postdoctoral scholars sponsored:** none



## Biographical Sketch

**Boyd Edwards, Ph. D.**  
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**E-mail:** bedwards@wvu.edu

### a. Professional Preparation

Utah State University	Physics	B. S. 1980
Utah State University	Physics	M. S. 1983
Stanford University	Applied Physics	Ph. D. 1985
Sandia National Laboratories, Livermore, CA	Applied Physics	1985-86 Postdoctoral Fellow

### b. Appointments

2005-present	Bolton WVU Professor, Department of Physics, West Virginia University
2000-2001	National Research Council Senior Associate, NETL
1996-2005	Professor of Physics, West Virginia University
1991-1996	Associate Professor of Physics, West Virginia University
1986-1991	Assistant Professor of Physics, West Virginia University

### c. Publications

#### (i) Publications most closely related to proposal

Reschke, B. R., Luo, H., Schiffbauer, J., Edwards, B. F., & Timperman, A. T. (2009). A theoretical and experimental study of the electrophoretic extraction of ions from a pressure driven flow in a microfluidic device. *Lab on a Chip*, 9, 2203.

Edwards, B. F., Timperman, A. T., Carroll, R. L., Jo, K., Mease, J. M., & Schiffbauer, J. E. (2009). Traveling wave electrophoresis for microfluidic separations. *Physical Review Letters*, 102, 076103.

Edwards, B. F. (2009). Self-similar nested sequences on a chaotic attractor for traveling-wave electrophoresis. *Physical Review E*, 80, 036205.

Edwards, B. F. (2006). Propagation velocities of chemical reaction fronts advected by Poiseuille flow. *Chaos*, 16, 043106.

Edwards, B. F., & Spangler, R. S. (2003). Poiseuille advection of chemical reaction fronts: Eikonal approximation. *Journal of Chemical Physics*, 118, 5911.

#### (ii) Other publications

Edwards, B. F. (2002). Poiseuille advection of chemical reaction fronts. *Physical Review Letters*, 89, 104501.

Edwards, B. F., & Smith, D. H. (2002). River meandering dynamics. *Physical Review E*, 65, 046303.

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

Masere, J., Vasquez, D. A., Edwards, B. F., Wilder, J. W., & Showalter, K. (1994). Nonaxisymmetric and axisymmetric convection in propagating reaction-diffusion fronts. *Journal of Physical Chemistry*, 98, 6505.

Vasquez, D. A., Wilder, J. W., & Edwards, B. F. (1993). Convective Turing patterns. *Physical Review Letters*, 71, 1538.

#### **d. Synergistic Activities**

1. Recipient, Russell and Ruth Bolton WVU Professor of Outstanding Teaching, a five-year Renewable endowed professorship, 2005-
2. Recipient, June Harless Award for Exceptional Teaching (1998), WVU Foundation Outstanding Teacher Award (1992), and WVU College of Arts and Sciences Outstanding Teacher Award (1992)
3. Chair, development of a team-taught freshman course in nanotechnology design at WVU (taught for the first time Spring 2007)
4. Author, paper in the *European Journal of Physics* (2001-Vol. 22, p. 113), a journal devoted to maintaining and improving the standard of physics taught in universities
5. Participant, WVNano Initiative: electrokinetics at microfluidic-nanofluidic interfaces

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Carroll, R. L.	West Virginia University	Smith, D. H.	NETL
Edwards, W. F.	Utah State University	Spangler, R. S.	Bethany College
Gray, D. D.	West Virginia University	Timperman, A. T.	West Virginia University
Huang, J.	Michigan State University	Vasquez, D. A.	Indiana Univ.-Purdue
Scime, E. E.	West Virginia University	Wilder, J. W.	West Virginia University

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisors:** M. S.: W. F. Edwards—Utah State University; Ph. D.: A. L. Fetter—Stanford University

**Postdoctoral Sponsor:** A. R. Kerstein, Sandia National Laboratories

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Robert Carroll, Jarrod Schiffbauer, James Vopal —WVU; Anjan Ghosal, Joseph Littley, Jie Huang—Michigan State University; Hao Luo—University of Wisconsin; R.S. Spangler—Bethany College; Dan Yao, Yunging Wu, T-Systems, Reston, VA

**Postgraduate-Scholar Sponsor:** S. Bleher—WVU; Mao Cai, M.F. Gyure—HRL Laboratories; Eugenia Kuo—Institute for Nuclear Geophysics; D.A. Vasquez, Indiana University—Purdue University

**Number of graduate students advised:** 10

**Number of postdoctoral scholars sponsored:** 4

## Biographical Sketch

### Parviz Famouri, Ph. D.

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### a. Professional Preparation

Kentucky State University	Applied Mathematics	B. S. 1981
University of Kentucky	Electrical Engineering	B. S. 1982
University of Kentucky	Electrical Engineering	M. S. 1986
University of Kentucky	Electrical Engineering	Ph. D. 1990

### b. Appointments

2005-present	Associate Chair for Research and Graduate Studies, Lane Department of Computer Science and Electrical Engineering, West Virginia University
2002-present	Professor, Lane Department of Computer Science and Electrical Engineering, West Virginia University
1996-2002	Associate Professor, Computer Science and Electrical Engineering, West Virginia University
1992-present	Director of Electro-Mechanical Systems (EMS) Laboratory, Department of Computer Science and Electrical Engineering, West Virginia University
1990-1996	Assistant Professor, Electrical and Computer Engineering, West Virginia University
1994 (May-August)	Research Scientist, Emerson Motor Technology Center, St. Louis, MO
1986-1990	Research Assistant, Electrical Engineering Department, University of Kentucky
1979-1981	Assistant Operator in Computing Center at Kentucky State University

### c. Publications

#### (i) Publications most closely related to proposal

- Jalali, A., Sims, C. S., & Famouri, P. (2006). *Reduced order systems* (M. Thomas, F. Allgower, & M. Morari, Eds., *Lecture notes in control and information sciences series*). Heidelberg, Germany: Springer.
- Lee, Y., Carroll, L., Holland, L., & Famouri, P. (2008, August). Biomolecular shuttles under dielectrophoretic forces. *Proceedings of the 8<sup>th</sup> IEEE Conference on Nanotechnology*, 667-672.
- Takatsuki, H., Chilakamarri, R., Famouri, P. & Kohama, K. (2006, June). Electrophoretic mobility of nano-sized actin filaments in biomolecular device. *Proceedings of the 6<sup>th</sup> IEEE Conference on Nanotechnology*, 1, 166-169.
- Famouri, P., Takatsuki, H., Hornak, L., Brown, K., Chilakamarri, R., Timperman, A., et al. (2005, May). Nanofilament directional control within a hybrid microelectronic actin-myosin motility assay via integrated electric field addressing. *Proceedings of the NSTI-Nanotech Conference*, 636-639.
- Izadian, A., & Famouri, P. (2008, July). Reliability enhancement of micro comb resonators under fault conditions. *IEEE Transactions on Control Systems Technology*, 16(4), 726-734.

**(ii) Other publications**

Park, J., Wang, L., Dawson, J. M., Hornak, L. A., & Famouri, P. (2005). Sliding mode based microstructure torque and force estimations using MEMS optical monitoring. *IEEE Sensors Journal*, 1-7.

Wang, L., Dawson, J. M., Hornak, L. A., & Famouri, P. (2004, April). Real-time translational control of a MEMS comb resonator. *IEEE Transaction on Aerospace and Electronic Systems*, 40(2), 567-575.

Dawson, J. M., Wang, L., Famouri, P., & Hornak, L. A. (2003, July 13). Grating-enhanced through-wafer optical microprobe for microelectromechanical system high-resolution optical position feedback. *Optics Letters*, 28(14), 1263-1265.

Dawson, J. M., Chen, J., Brown, K. S., Famouri, P., & Hornak, L. A. (2000, December). Through-wafer interrogation of microstructure motion for MEMS feedback control. *SPIE Journal of Optical Engineering*, 39(12), 3239-3246.

Park, J., Wang, L., Dawson, J., Hornak, L., & Famouri, P. (2002, June). Microstructure state estimation using MEMS optical monitoring [invited paper]. *Proceedings of IEEE Sensors 2002 Conference*, 2, 1746-1750. Nominated for the Best Conference Paper Award.

S. Hashem, S., Mathur, A., & Famouri, P. (1999, July). Neural networks based chemical Process models. *Proceedings of the 1999 International Joint Conference on Neural Networks*, 6, 3948-3951.

**d. Synergistic Activities**

1. Organizer and member, WVNano Initiative
2. Member, WVU faculty group developing an international graduate student exchange program (International Innovation Program)
3. Member, Administrative Committee of IEEE Nanotechnology Council in charge of NTC technical chapters worldwide

**e. Collaborations and Other Affiliations**

**(i) Collaborators and Co-Editors**

Eric Blough	Marshall University	Randall Gemmen	DOE/NETL
Edward Boyle	DOE/NETL	R. Ghaffarian	Jet Propulsion Laboratories
Lloyd Carroll	WVU	Lisa Holland	WVU
Peter Gannett	WVU	Nick Wu	WVU

**(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisor:** Jim Cathey University of Kentucky

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** M. S., WVU—H. Shim, Gang Wang, Sharon Clark, D. Rerkpreedapong, Scott Rittenhouse, Junji Matsamoto, Jing Wang; Ph. D., WVU—Jingdon Chen, Juchil Park, Hokyung Hwang, Limin Wang, William Cawthorne

**Postgraduate-Scholar Sponsor:** WVU—Hideyo Takatsuki, Jeremy Dawson

**Number of graduate students advised:** 18

**Number of postdoctoral scholars sponsored:** 2

## Biographical Sketch

### Feruz Ganikhanov

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### a. Professional Preparation

M. V. Lomonosov Moscow State University	Physics	B. S. 1985
M. V. Lomonosov Moscow State University	Physics	M. S. 1987
M. V. Lomonosov Moscow State University	Physics	Ph.D. 1991

### b. Appointments

2006-present	Assistant Professor, Department of Physics, Eberly College of Arts and Sciences, West Virginia University
2004-2006	Research Scientist, Department of Chemistry and Chemical Biology, Harvard University (Cambridge, MA) and Wellman Laboratories for Photomedicine, MGH, Harvard Medical School (Boston, MA)
2000-2003	Member of Technical Staff, Digital and Tunable Lasers Group, Lucent Technologies/Agere Systems, Optoelectronics Center (Breinigsville, PA)
1999-2000	Senior Laser Physicist, Laser Systems R&D Group, INRAD, Inc. (Northvale, NJ)
1996-1999	Postdoctoral Research Associate, Femtosecond Optics and Spectroscopy Group, Department of Electrical Engineering and Applied Physics, Cornell University
1994-1996	Charge de Recherche, Laboratoire de Optique Quantique, Ecole Polytechnique (Palaiseau, France)
1988-1993	Graduate Research Assistant, Associate Scientist, R. V. Khokhlov Nonlinear Optics Laboratory, Department of Physics, Moscow State University

### c. Publications

#### (i) Publications most closely related to proposal

Ganikhanov, F., Evans, C. L., Saar, B. G., et al. (2006). High-sensitivity vibrational imaging with frequency modulation coherent anti-Stokes Raman scattering (FM CARS) microscopy. *Optics Letters*, 31, 1872.

Legare, F., Evans, C. E., Ganikhanov, F., & Xie, X.-S., (2006). Towards CARS endoscopy. *Optics Express*, 14, 4427.

Pfeffer, C. P., Olsen, B., Ganikhanov, F., & Legare, F. (2008). Multimodal nonlinear optical imaging of collagen arrays. *Journal of Structural Biology*, 164, 140.

Bhupathiraju, K., Seymour, A., & Ganikhanov, F. (2009). Femtosecond optical parametric oscillator based on periodically poled LiTaO<sub>3</sub> crystal. *Optics Letters*, 34, 2092.

Bhupathiraju, K., Seymour, A., & Ganikhanov, F. (2009). Efficient picosecond optical parametric oscillator based on periodically poled lithium tantalate. *Applied Physics Letters*, 95, 081111.

#### (ii) Other publications

Ganikhanov, F., Carrasco, S., Xie, X.-S., et al. (2006). Broadly tunable dual-wavelength light source for coherent anti-Stokes Raman scattering microscopy. *Optics Letters*, 31, 1292.

Ganikhanov, F., & Vallee, F. (1997). Coherent TO phonon relaxation in GaAs and InP. *Physical Review B*, 55, 15614.

Ganikhanov, F., Burr, K. C., & Tang, C. L. (1998). Ultrafast dynamics of holes in GaAs probed by two-color femtosecond spectroscopy. *Applied Physics Letters*, 73, 64.

Ganikhanov, F., Burr, K. C., Hilton, D. J., & Tang, C.L. (1999). Femtosecond optical-pulse-induced absorption and refractive-index changes in GaAs in the mid-infrared. *Physical Review B*, 60, 8890.

Vallee, F., Ganikhanov, F., & Bogani, F. (1997). Dephasing of LO-phonon-plasmon hybrid modes in n-type GaAs. *Physical Review B*, 56, 13141.

#### **d. Synergistic Activities**

1. Prepared curriculum for and taught new Nonlinear Optics course (PHYS 791A), Spring 2007
2. Taught General Physics course (PHYS 111) for undergraduate students, Spring 2008
3. Taught Advanced Physics Laboratories course (PHYS 341), Spring 2009

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

S. Carrasco	ICFO, Barcelona, Spain
C. Evans	Wellman Labs for Photomedicine, Harvard Medical School
F. Legare	INRS-EMT, Varennes, Canada
C. P. Pfeiffer	Harvard Medical School
E. O. Potma	University of California-Irvine
S.-X. Xie	Department of Chemistry and Chemical Biology, Harvard University

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Graduate Advisor:</b>	V. G. Tunkin	Moscow State University, Moscow, Russia
<b>Postdoctoral Sponsors:</b>	C. Flytzanis	Ecole Normale Supérieure, Paris, France
	C. L. Tang	Cornell University
	X.-S. Xie	Harvard University

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Joseph Rowley, Andrew Seymour—WVU

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 3

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Peter M. Gannett, Ph.D.

Professor of Medicinal Chemistry  
Associate Chair, Department of Basic Pharmaceutical Sciences  
West Virginia University  
School of Pharmacy  
P.O. Box 9530  
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**Fax:** 304.293.2576

### a. Professional Preparation

University of Missouri-Columbia	Chemistry	B.S. 1977
University of Wisconsin-Madison	Physical Organic Chemistry	Ph.D. 1982
University of Wisconsin-Madison	Synthetic Organic Chemistry	1982-1983
Eppley Cancer Institute, University of Nebraska Medical Center	Chemical Carcinogenesis	1985-1986 Postdoctoral Fellow

### b. Appointments

2000-present	Professor, School of Pharmacy, West Virginia University
1998-present	Director, Computational Chemistry and Molecular Modeling Lab, West Virginia University
1997-present	Associate Chair, Department of Basic Pharmaceutical Science, Pharmacy, West Virginia University
1995-1997	Interim Chair, Department of Basic Pharmaceutical Science, Pharmacy, West Virginia University
1994-present	Associate Professor, School of Pharmacy, West Virginia University
1990-1994	Assistant Professor, School of Pharmacy, West Virginia University
1988-1990	Research Assistant Professor, Eppley Cancer Institute, University of Nebraska Medical Center
1986-1988	Research Instructor, Eppley Cancer Institute, University of Nebraska Medical Center
1985-1986	Research Associate, Eppley Cancer Institute, University of Nebraska Medical Center
1983-1985	Senior Research Chemist, Organic and Rubber Chemicals, Mobay Chemical Corp., Pipttsburgh, PA
1982-1983	Research Associate, Department of Pharmacy, University of Wisconsin-Madison

### c. Publications

#### (i) Publications most closely related to proposal

- Tracy, T. S., Hummel, M. A., Gannett, P. M., & Aguilar, J. S. (2004). Effector-mediated alteration of substrate orientation in cytochrome P450 enzymes. *Biochemistry*, *43*, 7207-7214.
- Locuson, C. W., Gannett, P. M., & Tracy, T. S. (2006). Heteroactivator effects on the coupling and spin state equilibrium of CYP2C9. *Archives of Biochemistry and Biophysics*, *449*, 115-129.
- Gannett, P. M., Kabulski, J., Perez, F. A., Liu, Z., Lederman, D., Locuson, C. W., et al. (2006). Preparation, characterization, and substrate metabolism of gold-immobilized cytochrome P450 2C9. *Journal of the American Chemical Society*, *128*, 8374-8375.
- Locuson, C. W., Gannett, P. M., Ayscue, R. R., & Tracy, T. S. (2007). Discovery of heteroactivators of cytochromes P450 using virtual library screening. *Journal of Medicinal Chemistry*, *50*, 1158-1165.
- Wang, H., Cheatham, T. E., III, Gannett, P. M., & Lewis, J. P. (2009). Dynamics of A-B transition of the DNA double helices. *Soft Matter*, *5*, 685-690.

## (ii) Other publications

- Gannett, P. M., Heavner, S., Daft, J. R., Shaughnessy, K., Epperson, J. D., & Greenbaum, N. L. (2003). Synthesis, properties, and NMR studies of a C8-phenylguanine modified oligonucleotide that preferentially adopts the Z-DNA conformation. *Chemical Research in Toxicology*, 16, 1385-1394.
- Darian, E., & Gannett, P. M. (2004). Application of molecular dynamics to spin-labeled oligonucleotides. *Journal of Biomolecular Structure and Dynamics*, 22, 579-594.
- Heavner, S., & Gannett, P. M. (2005). Molecular dynamics and free energy calculations of the B and Z forms of C8-arylguanine modified oligonucleotides. *Journal of Biomolecular Structure and Dynamics*, 23, 203-219.
- Mohler, D. L., Downs, J. R., Hurley-Predecki, A. L., Sallman, J. R., Gannett, P. M., & Shi, X. (2005). DNA cleavage by the photolysis of cyclopentadienyl metal complexes: Mechanistic studies and sequence selectivity of strand scission by CpW(CO)<sub>3</sub>CH<sub>3</sub>. *Journal of Organic Chemistry*, 70, 9093-9102.
- Yang, M., Kabulski, J. L., Wollenberg, L., Chen, X., Tracy, T. S., Gannett, P. M., et al. (2009). Electrocatalytic drug metabolism by cytochrome P450 enzyme bonded to a self-assembled monolayer modified electrode. *Drug Metabolism and Disposition*, 37, 892-899.

## d. Synergistic Activities

1. Developer and current director, Computational Chemistry and Molecular Modeling Laboratory, WVU
2. Director, Computational and Structural Biology Core Facility
3. Mentor, WV-BRIN and WV-INBRE program (mentor to Dr. Jarrett Aguilar, West Liberty State College), 2002-present
4. Previous mentor, NSF-REU (Virtual Environments REU Site)
5. Organizer and member, WVNano Initiative

## e. Collaborators and Other Affiliations

### (i) Collaborators and Co-Editors

Abate, M. A.	WVU	Lederman, D.	WVU
Brunel, L.-C.	National High Field Magnet Laboratory, Tallahassee, FL	Shaughnessy, K. H.	University of Alabama-Tuscaloosa
Budil, D.	Northeastern University	Shi, X.	National Inst. for Occupational Safety & Health
Dalal, N.	Florida State University	Toth, B.	Eppley Cancer Research Inst., UNMC
Greenbaum, N. L.	Florida State University	Tracy, T. S.	Univ. of Minnesota
Lawson, T.	Eppley Cancer Research Inst., UNMC		

### (ii) Graduate Advisors and Postdoctoral Sponsors

<b>Graduate Advisors:</b>	Stephen F. Nelsen	University of Wisconsin-Madison
	Charles Sih	University of Wisconsin-Madison
<b>Postdoctoral Sponsor:</b>	Bela Toth	Eppley Cancer Research Institute, UNMC

### (iii) Thesis Advisor and Postgraduate-Scholar Sponsor

**Thesis Advisor:** Wai-Ming Yau, Deepak Thakkar, Claudius Mundoma, Jeannine Powell, Eva Darian, Sue Heavner, Jonathan Daft, Robyn Ayscue, Vorasit Vongsutilers, Jarod Kabulski, Lance Wollenberg, Brian Train, John Jett, Nissa Thomsen—WVU

**Postgraduate-Scholar Sponsor:** Tushara Sura, Padma Tirumalai—WVU

**Number of graduate students advised:** 14

**Number of postdoctoral scholars sponsored:** 2



## Biographical Sketch

**Gerald R. Hankins, Ph. D.**  
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**E-mail:** ghankins@wvstateu.edu

### a. Professional Preparation

Florida State University	Statistics, Mathematics Physics	B. S. 1972
George Washington University	Mathematical Statistics	M. A. 1978
University of Virginia	Biology	Ph. D. 1991
Duke University	Radiation Oncology	1991-1996
		Postdoctoral Research

### b. Appointments

2005-present Assistant Professor, Department of Biology, West Virginia State University  
2004- 2005 Assistant Professor, Department of Biology, Millersville University, PA  
1996-present Assistant Professor of Research, Department of Neurological Surgery, University of Virginia (secondary since October 2004)  
1993-1996 Instructor, Biotechnology Department, Alamance Community College, Graham, NC  
1991-1996 Research Associate, Division of Cancer Biology, Radiation Oncology, Duke University  
1988-1990 Graduate Research Assistant, Department of Biology, University of Virginia  
1983, 1985 Graduate Instructor, Department of Biology, University of Virginia  
1978-1982 Research Statistician, Gillette Medical Evaluation Labs, Rockville, MD  
1974-1978 Statistician, Research Statistician, Gillette Medical Evaluation Labs, Rockville, MD  
1972-1974 Assistant Statistician, The Mortgage Bankers Association of America, Washington, DC

### b. Publications

#### (i) Publications most closely related to proposal

Hankins, G. R., Sasaki, T., Lieu, A.-S., Saulle, D., Karimi, K., Li, J. Z., et al. (2008). The identification of deleted in liver cancer-1 (*DLC1*) as a candidate meningioma tumor suppressor. *Neurosurgery*, 63, 771-781.

Lieu, A.-S., Li, J. Z., Webb, D. J., Hankins, G. R., Howng, S. L., & Helm G. A. (2006). Functions of GIT1 in human neuronal (NT2N) cells. *Journal of Neurosurgery*, 105, 103-110.

Li, H., Li, J. Z., Pittman, D., Amalfitano, A., Hankins, G. R., & Helm, G. A. (2006). Comparison of osteogenic potentials of human rat BMP4 and BMP6 gene therapy using [E1-] and [E1-,E2b-] adenoviral vectors. *International Journal of Medical Sciences*, 3, 97-105.

Lieu, A. S., Wang, Y., Li, J. Z., Webb, D. J., Hankins, G. R., Helm, G. A., et al. (2006). G protein-coupled receptor kinase interacting protein 1 slows down the apoptosis process of retinal ganglion cells in a rat model. *Molecular Therapy*, 1, S341-342.

Li, J. Z., Li, H., Hankins, G. R., Liu, A.-S., Noh, E., Jacobson, L., et al. (2006). Different osteogenic potentials of recombinant human BMP-6 adeno-associated virus and adenovirus in two rat strains. *Tissue Engineering*, 12, 209-219.

#### (ii) Other publications

none

#### **d. Synergistic Activities**

Currently involved in research targeting:

1. Gene expression changes leading to the abnormal development in cancer, particularly in the identification of and mechanism of action of tumor suppressor genes
2. Screening of natural products for pharmacological activity, particularly for anticancer activity
3. Analysis of developmental pathways activated in gene therapy

#### **c. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Amalfitano, Andrea	Duke University Medical Center
Bourne, David T.	University of Virginia
Chin, Kit	Southern University
Chiorini, John A.	National Institutes of Health
Helm, Gregory A.	University of Virginia
Howng, Shen-Long	Fooyin University, Kaohsiung, Taiwan
Li, Hongwei	University of Florida
Li, Jin Zhong	Immune Design Corporation, Seattle, WA
Lieu, Ann-Shung	Kaohsiung Medical Universtiy, Kaohsiung, Taiwan
Park, Maiyon	Marshall University
Rankin, Gary O.	Marshall University
Sasaki, T.	Institute for Molecular and Cellular Regulation, Gunma University, Japan
Saulle, Dwight	University of Virginia
Simon, James E.	Rutgers University
Karimi, Kambiz	Ingenuity Systems, Redwood City, CA
Pittman, Debra D.	Genetics Institute, Andover, MA
Webb, Donna J.	Vanderbilt University

##### **(ii) Graduate Advisor and Postdoctoral Sponsor**

**Graduate Advisor:** Wright, Theodore R.F. (emeritus)—University of Virginia

**Postdoctoral Sponsor:** Jirtle, Randy L.—Duke University Medical Center

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Velvet Worstell, Chris Racine, Sumanth Monohar, Sophia Brown—West Virginia State University

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 4

**Number of postgraduate scholars sponsored:** none

## Biographical Sketch

### Lisa Holland, Ph.D.

357 Chemistry Research Laboratory  
P.O. Box 6045  
Morgantown, WV 26506

Phone: 304.293.3435

E-mail: lisa.holland@mail.wvu.edu

### a. Professional Preparation

University of Maryland-College Park	Chemistry	B.S. 1990
University of North Carolina-Chapel Hill	Chemistry	Ph.D. 1996
University of Kansas	Chemistry	1996-1998
		Postdoctoral Research

### b. Appointments

2008-present	Associate Professor, Chemistry Department, West Virginia University
2002-2008	Assistant Professor, Chemistry Department, West Virginia University
1999-2002	Assistant Professor, Kent State University
1996-1998	National Research Service Award Researcher, NCI Training Center, Department of Pharmaceutical Chemistry, University of Kansas
1991-1996	Research Assistant, University of North Carolina
1985-1990	Research Technician, National Institute of Standards and Technology

### c. Publications

#### (i) Publications most closely related to proposal

Pappas, T. J., & Holland, L. A. (2008). Fluid steering in a microfluidic chip by means of thermally responsive phospholipids. *Sensors and Actuators B: Chemical*, 128, 427-434.

White, C. M., Luo, R., Archer-Hartmann, S. A., & Holland, L. A. (2007). Electrophoretic screening of ligands under suppressed electroosmotic flow with an inert phospholipid coating. *Electrophoresis*, 28(17), 3049-3055.

Holland, L. A., Pappas, T. J., Nilsson, S., & West, J. (2006, March). Non-mechanical liquid crystal-based fluid control (ledison Rep. No. 9163701-05-0005).

Holland, L. A. & Leigh, A. (2003). Bilayered phospholipid micelles and capillary electrophoresis: A new additive for electrokinetic chromatography. *Electrophoresis*, 24(17), 2935-2939.

Mills, J. & Holland, L. A. (2004). Membrane mediated capillary electrophoresis: Interaction of cationic peptides with bicelles. *Electrophoresis*, 25(9), 1237-1242.

#### (ii) Other publications

Anderson, M., Holland, L. A., & Pappas, T. J. (2005.) Temperature control of running buffer: An integrated modification to the Beckman P/ACE™ MDQ. *P/ACE Setter*, 9(1), 9-11.

McKeon, J. & Holland, L. A. (2004). The determination of dissociation constants for a heparin-binding domain of amyloid precursor protein and heparins or heparan sulfate by affinity capillary electrophoresis. *Electrophoresis*, 25(9), 1243-1248.

Hanson, K. M., Gayton-Ely, M., Holland, L. A., Zehr, P., & Soderberg, B. C. G. (2005). Rapid assessment of beta-Asarone content of *Acorus calamus* by micellar electrokinetic capillary chromatography. *Electrophoresis*, 26(4-5), 943-946.

Holland, L. A., Tomechko, S., Oommen, A., Leigh, A. M., Bradford, A., & Burns, A. (2004). Real-time distance research with IP network videoconferencing: Extending undergraduate research opportunities. *Journal of Chemical Education*, 81, 1224-1228.

Luo, R., Langan, T. J., & Holland, L. A. (2004, October 4; updated 2006, December 28). Capillary electrophoresis distance learning program: Guided discovery on the principles, assembly, operation and application of a custom built capillary electrophoresis system (2<sup>nd</sup> ed.). *Journal of the Analytical Sciences Digital Library*, 10031.

#### **d. Synergistic Activities**

1. Faculty mentor—mentored WVU undergraduate student and guided WVU graduate student in mentoring of undergraduate research, Student Undergraduate Research Experience (SURE), 2005-2009
2. Faculty mentor—guided scientific discovery of 10 and lectured to 20 top West Virginia high school students, Governor's School of Math and Science, 2004
3. Session presenter—Expanding Your Horizons, workshop serving 55 girls in grades 5 through 9, sponsored by West Virginia Association for Women in Science, 2003
4. Participant—Minorities in the Chemical Workforce: Diversity Models That Work, National Research Council of the National Academies, 2002

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Suzanne Bell	West Virginia University
Parviz Famouri	West Virginia University
Christy Foran	West Virginia University
Chuck Haines	Haskell Indian Nations University
Mike Miller	West Virginia University
Fred Nesbitt	Coppin State University
Staffan Nilsson	University of Lund
George O'Doherty	West Virginia University
Eric Pyle	James Madison University
Rosana Shafer	West Virginia University
John West	Kent State University

##### **(ii) Graduate and Postdoctoral Advisors**

Jim Jorgenson	University of North Carolina-Chapel Hill
Susan Lunte	University of Kansas

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

###### **Thesis Advisor**

Liliya Bykova	West Virginia University
Theron Pappas	West Virginia University
Stephanie Archer-Hartmann	West Virginia University
Ted Langan	West Virginia University
Ruijuan Luo	West Virginia University
Christian White	West Virginia University
Xingwei Wu	West Virginia University

###### **Postgraduate-Scholar Sponsor**

Jocelyn McKeon	West Virginia University
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**Number of graduate students advised: 15**

**Number of postdoctoral scholars sponsored: 1**

## Biographical Sketch

### Lawrence A. Hornak, Ph. D.

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P.O. Box 6109  
West Virginia University  
Morgantown, WV 26506

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### a. Professional Preparation

Binghamton University (SUNY)  
Stevens Institute of Technology  
Rutgers University

Physics  
Electrical Engineering  
Electrical Engineering

B. S. 1982  
M. E. 1986  
Ph. D. 1991

### b. Appointments

2006-present	Co-Director, NSF Center for Identification Technology and Research (CITeR)
2006-2008	Co-Director, WVNano Initiative
2005-2006	Interim Director, WVNano Initiative
2001-present	Professor, Lane Department of Computer Science and Electrical Engineering, West Virginia University
2001-2006	Founding Director, NSF Center for Identification Technology Research
1999-2002	Research Director, CSEE
1997-1998	Co-Interim Chair, Computer Science and Electrical Engineering Department, West Virginia University
1996-1997	Interim Chair, Electrical and Computer Engineering Department, West Virginia University
1996-present	Director, Microelectronic Systems Research Center (MSRC)
1994-2001	Associate Professor, Lane Department of Computer Science and Electrical Engineering, West Virginia University
1991-1994	Assistant Professor, Lane Department of Computer Science and Electrical Engineering, West Virginia University
1982-1991	Member of Technical Staff, Digital Optics Research Department, AT&T Bell Laboratories, Communications Systems Research Laboratory, Holmdel, NJ

### c. Publications

#### (i) Publications most closely related to proposal

- Nightingale, J. R., Goswami, R., Duperre, J., Dawson, J. M., Hornak, L. A., & Korakakis, D. (2008). Use of ion beam assisted deposition and low temperature annealing for the fabrication of low loss, vertically stacked alumina waveguide structures. *Journal of Vacuum Science and Technology*, 26, 1813.
- Dawson, J. M., Nightingale, J. R., Tompkins, R. P., Yeldandi, S., Myers, T. H., & Hornak, L. A. (2008). Design and characterization of optofluidic photonic crystal structures for the detection of fluorescent-labeled biomolecules. *ECS Transactions*, 13 (22), 27.
- Lim, M. S., Feng, K., Chen, X., Wu, N., Raman, A., Hornak, L. A., et al. (2007, February). Adsorption and desorption of stearic acid self-assembled monolayer on aluminum oxide. *Langmuir*, 23(5), 2444-2452.
- Schuckers, S. A. C., Schmid, N. A., Abhyankar, A., Dorairaj, V., Boyce, C., & Hornak, L. A. (2007). On techniques for angle compensation in non-ideal iris recognition. *IEEE Transactions on SMC, Part B*, 37(5), 1176-1190.

Boyce, C., Ross, A., Monaco, M., Hornak, L., & Li, X. (2006, June). Multispectral iris analysis: A preliminary study. *Proceedings of IEEE Computer Society Workshop on Biometrics*, 51-59.

#### **(ii) Other publications**

Woodruff, S. D., Ayyalasomayajula, N., & Hornak, L. A. (2006). Design and characterization of a diode-pumped Nd:YAG retro-reflecting slab laser. *Journal of Optical Engineering*, 45(12).

Schuckers, S. A. C., & Hornak, L. A., (2005). Liveness detection in biometric devices. In D. Etter (Ed.), *Electrical Engineering Handbook* (3rd ed., Chapter 26). New York: CRC Press.

Parthasaradhi, S. T. V., Derakhshani, R. R., Hornak, L. A., & Schuckers, S. A. C. Time series detection of perspiration as a liveness test in fingerprint devices. (2005). *IEEE – Systems, Man, and Cybernetics Society, Part C: Applications and Reviews – Special Issue on Biometric Systems*, 35(3), 335-343.

Lloyd, D., Hornak, L., Pathak, S., Morton, D., & Stevenson, I. (2004). Application of ion beam assisted thin film deposition techniques to the fabrication of a biosensor chip with fieldability potential for important biohazard detection applications. *47th Annual Technical Conference Proceedings, Society of Vacuum Coaters*, 48-57.

Derakhshani, R., Schuckers, S. A. C., Hornak, L. A., & O’Gorman, L. (2003). 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.

#### **d. Synergistic Activities**

1. Led effort to develop first Biometric Systems Bachelor of Science degree and graduate certificate
2. Member of faculty team developing and teaching the 1<sup>st</sup> crosscutting freshman NSE course at WVU
3. Co-PI of NSF Nanoscale Undergrad Education (NUE) funded NSE undergrad emphasis at WVU
4. Collaboratively formed multiuniversity team and successfully established CITeR as an NSF I/UCRC
5. Founding faculty team member and co-director of WVNano, the statewide WV NSEE initiative

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Fred Dickey	Sandia National Labs	Anil Jain	MSU
Parviz Famouri	EE/WVU	Aaron Timperman	Chemistry/WVU
Donald Lloyd	LAI, Westmin., MD	Stuart Tewksbury	Stevens Inst. of Tech.
Thomas Myers	Physics/WVU	Reza Gheffarian	NASA/JPL
S. Woodruff	NETL-DOE	Joel Faulk	Univ. of Pittsburgh

##### **(ii) Graduate Advisor and Postdoctoral Sponsors**

**Graduate Advisor:** B. Lalevic, Rutgers University

**Postdoctoral Sponsor:** none

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Dissertation Advisor:** Ke Feng—WV Wesleyan College; N. Ayyalasomayajula—WVU

**Postgraduate-Scholar Sponsor:** J. Dawson—WVU

**Number of graduate students advised:** 36 (M. S. and Ph. D.)

**Number of postdoctoral scholars sponsored:** 2

## Biographical Sketch

### Jennifer Kasi Jackson, Ph. D.

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### a. Professional Preparation

University of North Carolina-  
Chapel Hill

University of Kentucky

University of Kentucky

Biology/

Studio Art

Women's Studies

Biology

B. A. (Honors) 1994

Graduate Certificate 2000

Ph. D. 2003

### b. Appointments

2005-present

Assistant Professor, Center for Women's Studies, West Virginia University

2007-present

Adjunct Assistant Professor, Biology, West Virginia University

2007-present

Participant, WVNano

2003-2005

Postdoctoral Fellow, Women's Studies, University of Houston

### c. Publications

#### (i) Publications most closely related to proposal

Jackson, J. K. (2008). Gender, mad scientists, and nanotechnology. *Spontaneous Generations: A Journal for the History and Philosophy of Science*, 2(1), 45-55.

#### (ii) Other publications

Jackson, K. (2008). Feminism, animals, and science in Le Guin's animal stories. *Paradoxa*, 21, 205-230.

Crowley, P. H., Davis, H. M., Ensminger, A. L., Fuselier, L. C., Jackson, J. K., & McLetchie, D. N. (2004). A general model of local competition for space. *Ecology Letters*, doi: 10.1111/j.1461-0248.2004.00709.x.

Jackson, J. K. (2001). Unequal partners: Rethinking gender roles in animal behavior. In M. Mayberry, B. Subramaniam, and L. Weasel (Eds.), *A new generation of feminist science studies*. New York: Routledge.

Jackson, J. K. (2001). Coloration in female cichlids. *Journal of Aquaculture and Aquatic Sciences* (Special Edition—Cichlid research: State of the art, R. Coleman [Ed.]), 237-247.

Wang, J. H., Jackson, J. K., & Lohmann, K. J. (1998). Perception of wave surge motion by hatchling sea turtles. *Journal of Experimental Marine Biology and Ecology*, 229(2), 177-186.

### d. Synergistic Activities

1. PI, NSF Robert Noyce Scholarship Program, "Teaching Excellence at College for High Achievement in West Virginia (TEACH-WV)," (\$748,334) to develop scholarship and training program for 20 science and math majors to get a master's in education and 5-12 teacher certification
2. Co-PI, NSF NUE (The Nanosystems Emphasis – Valuing Disciplinary Depth and Differences in Nanoscale Science and Engineering Teams) to develop WVU nanotechnology emphasis area
3. Attended the SENCER (Science Education for New Civic Engagements) Summer Institutes (SSI), 2006, San Jose, CA. Organized/brought a team of 5 faculty and students to SSI, 2007

4. Implemented a "Biology in the News" project to add social context to large enrollment, nonmajors biology classes; currently working to extend the "In the News" model to introductory courses in chemistry, math, and science education

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

Martina Bachlechner	Fairmont State	Phyllis Barnhart	formerly WV Nano
Johnna Bolyard	WVU	Jane Caldwell	WVU
Lloyd Carroll	WVU	Jeffrey Carver	WVU
Mary Ann Clarke	WVU	Phillip Crowley	UK
David Drabold	OSU	Boyd Edwards	WVU
Amanda Ensminger	UK	Linda Fuselier	MSU-Morehead
Peter Gannett	WVU	Robin Hensel	WVU
Lawrence Hornak	WVU	Dimitris Korakakis	WVU
James Lewis	WVU	Ann Overhauser	WVU
Michelle Richards-Babb	WVU	Jennifer Robertson-Hohnecker	WVU
Nicolas McKletchie	UK	David Miller	WVU
Jim Rye	WVU	Leslie Tower	WVU

**(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Graduate Advisors:</b>	R. Craig Sargent	University of Kentucky
<b>Postdoctoral Sponsor:</b>	Elizabeth Gregory	University of Kentucky

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** none

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** none

**Number of postdoctoral scholars sponsored:** none



## Biographical Sketch

### Dimitris Korakakis, Ph. D.

745 Engineering Sciences Building  
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P.O. Box 6109  
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Fax: 304.293-8602

### a. Professional Preparation

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

### b. Appointments

2008-present	Associate Professor, Lane Department of Computer Science and Electrical Engineering, West Virginia University
2007-present	Resident Faculty Fellow, Institute of Advanced Energy Studies, National Energy Technology Laboratory and Universities Consortium
2002-2008	Assistant Professor, Lane Department of Computer Science and Electrical Engineering, West Virginia University
2000-2002	Research Assistant Professor, Department of Physics, West Virginia University
1997-2000	Research Associate, School of Physics and Astronomy and School of Electrical and Electronic Engineering, University of Nottingham, UK

### c. Publications

#### (i) Publications most closely related to proposal

Rodak, J. L. E., Kuchibhatla, S., & Korakakis, D. (2009). Suspended aluminum nitride structures grown via metal organic vapor phase epitaxy. *Materials Letters*, *63*, 1571-1573.

Guo, H., Brown, K., Korakakis, D., & Cao, X. A. (2009). Low-resistance, highly transparent, and thermally stable Ti/ITO Ohmic contacts to n-GaN. *Journal of Vacuum Science and Technology B*, *27*(3), 1161-1164.

Rahimi, R., Miller, C. M., Raghavan, S., Stinespring, C. D., & Korakakis, D. (2009). Electrical properties of strained nano-thin 3C-SiC/Si heterostructures. *Journal of Physics D: Applied Physics*, *42*, 055108.

Nightingale, J. R., Goswami, R., Duperre, J., Dawson, J. M., Hornak, L. A., & Korakakis, D. (2008). Use of ion beam assisted deposition and low temperature annealing for the fabrication of low loss, vertically stacked alumina waveguide structures. *Journal of Vacuum Science and Technology B*, *26*(5), 1813-1816.

Harman, J., Kabulski, A., Pagan, V. R., Famouri, P., Kasarla, K. R., Korakakis, D., et al. (2008). Effect of contact metals on the piezoelectric properties of aluminum nitride thin films. *Journal of Vacuum Science and Technology B*, *26*(4), 1417-1419.

#### (ii) Other publications

Lim, M. S., Feng, K., Chen, X., Wu, N., Raman, A., Korakakis, D., et al. (2007). Adsorption and desorption of stearic acid self-assembled monolayers on aluminum oxide. *Langmuir*, *25*, 2444-2452.

Cornell, T., Nightingale, R., Pathak, S., Hornak, L. A., & Korakakis, D. (2006). Thickness and Fourier transform infrared peak instability in silicon dioxide thin films deposited using

electron-gun deposition. *Journal of Vacuum Science and Technology B*, 24(5), 2250-2255.

Bachlechner, M. E., Zhang, J., Wang, Y., Schiffbauer, J., Knudsen, S. R., & Korakakis, D. (2005). Molecular dynamics simulations of the mechanical strength of Si/Si<sub>3</sub>N<sub>4</sub> interfaces. *Physical Review B*, 72, 094115.

Korakakis, D., Ludwig, K. F., Jr., & Moustakas, T. D. (1998). X-ray characterization of GaN/AlGaIn multiple quantum wells for laser diodes. *Applied Physics Letters*, 72, 1004.

Korakakis, D., Ludwig, K. F., Jr., & Moustakas, T. D. (1997). Long range ordering in AlGaIn films grown by ECR assisted MBE. *Applied Physics Letters*, 71, 72.

#### **d. Synergistic Activities**

1. Member, Institute of Electrical and Electronic Engineers, Materials Research Society, American Physical Society
2. Reviewer, National Science Foundation, Department of Energy
3. Lead faculty, Lane Experience in Applied Design, Lane Department of Computer Science and Electrical Engineering, WVU
4. Founding faculty team member, WVNano and the Institute of Advanced Energy Studies
5. Member, WVNano Steering Committee

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators**

K. Chen	University of Pittsburgh	M. Kasahara	University of Kyoto
J. Falk	University of Pittsburgh	S. Woodruff	NETL, DoE

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Graduate Advisor:</b>	T. D. Moustakas	Boston University
<b>Postdoctoral Sponsor:</b>	C. T. Foxon	University of Nottingham, UK

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Ting Liu—WVU  
**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 27

**Number of postdoctoral scholars sponsored:** 3

## Biographical Sketch

**David Lederman, Ph. D.**  
Hodges Hall G19  
West Virginia University  
Morgantown, WV 26506-6315

**Phone:** 304.293.3422 x 1494  
**E-mail:** david.lederman@mail.wvu.edu

### a. Professional Preparation

Stanford University	Physics	B.S. 1988 (with honors)
University of California-Santa Barbara	Physics	Ph. D. 1992
University of California-San Diego	Physics	1992-1993 Postdoctoral Research

### b. Appointments

2009-2013	Robert C. Byrd Professor, Physics Department, West Virginia University
2009-present	Carrol Chair Professor, Physics Department, West Virginia University
2008-present	Interim Director, WVNano Initiative, West Virginia University
2005-present	Professor, Physics Department, West Virginia University
2004-2006	Woodburn Professor, Eberly College of Arts and Sciences, West Virginia University
2001-2005	Associate Professor, Physics Department, West Virginia University
1995-2001	Assistant Professor, Physics Department, West Virginia University
1993-1995	Project Scientist, University of California-San Diego
1994	Lecturer, Physics Department, University of California-San Diego

### c. Publications

#### (i) Publications most closely related to proposal

Chandril, S., Keenan, C., Myers, T. H., & Lederman, D. (2009). In-situ thin film and multilayer structural characterization using x-ray fluorescence induced by reflection high energy electron diffraction. *Journal of Applied Physics*, 106, No. 024308.

Keenan, C., Chandril, S., Ramos, E., Cabrera, A. L., Myers, T. H., & Lederman, D. (2008). Properties of  $\text{YMnO}_3$  self-assembled nanocrystalline prisms on GaN. *Applied Physics Letters*, 92, No. 013119.

Yang, M., Kabulski, J. L., Wollenberg, L., Chen, X., Subrimanian, M., Lederman, D., et al. (2009). Electrocatalytic drug metabolism by CYP2C9 bonded to a self-assembled monolayer modified electrode. *Drug Metabolism and Disposition*, 37, 892.

Gannett, P. M., Kabulski, J., Wollenberg, L., Gu, J., Li, D., Lederman, D., et al. (2008). Cytochrome P450-gold nanobiochip platform for basic science research and practical applications. *Proceedings of the 15<sup>th</sup> International Conference on Cytochromes P450*, 69-73.

Gannett, P. M., Kabulski, J., Perez, F. A., Liu, Z., Lederman, D., Locuson, C. W., et al. (2006). Characterization, electrochemistry and substrate metabolism of gold-immobilized cytochrome P450 2C9. *Journal of the American Chemical Society*, 128, 8374.

#### (ii) Other publications

Ohldag, H., Shi, H., Arenholz, E., Stöhr, J., & Lederman, D. (2006). Parallel versus antiparallel interfacial coupling in exchange biased  $\text{Co/FeF}_2$ . *Physical Review Letters*, 96, No. 027203.

Delgado, E., Ostos, C., Martinez-Sarrion, M. L., Mestres, L., Lederman, D., & Prieto, P. (2009). Growth and characterization of BLZT-CFO composite thin films. *Materials Chemistry and Physics*, 113, 702.

Cheon, M., Liu, Z., & Lederman, D. (2007). Reversible exchange bias and uncompensated magnetization in  $\text{Fe}_x\text{Ni}_{1-x}\text{F}_2/\text{Co}$  bilayers. *Applied Physics Letters*, 90, No. 012511.

Chye, Y., Liu, T., Li, D., Lee, K., Lederman, D., & Myers, T. H. (2006). Molecular beam epitaxy of  $\text{YMnO}_3$  on c-plane GaN. *Applied Physics Letters*, 88, No. 132906.

Espinosa, J., Shi, H., & Lederman, D. (2005). Superparamagnetic behavior of cobalt nanodots on  $\text{Al}_2\text{O}_3$  (0001). *Journal of Applied Physics*, 97, No. 10B310.

#### **d. Synergistic Activities**

1. Recipient, Outstanding Researcher Award, Eberly College of Arts and Sciences, West Virginia University, 2004
2. Member, American Physical Society, Materials Research Society, National Society of Hispanic Physicists
3. Developer, 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
4. WVNano Functional Building Block Group leader (Electronic Transduction), helped draft nanoscience strategy at WVU, 2004-present
5. 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 campus-wide (2002-2003)

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

E. Arenholz	ALS
J. Borchers	NIST
M. Fitzsimmons	Los Alamos
A. Hoffmann	Argonne National Laboratory
T. H. Myers	Texas State University
H. Ohldag	SSRL
J. Stohr	SSRL
S. Te-Velthuis	Argonne National Laboratory

##### **(ii) Graduate and Postdoctoral Advisors**

<b>Graduate Advisor:</b>	Prof. V. Jaccarino	University of California-Santa Barbara
<b>Postdoctoral Advisor:</b>	Prof. I. K. Schuller	University of California-San Diego

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Ph.D. Thesis Advisor:** Timothy Charlton, Hongtao Shi, Jorge Espinosa, Debin Li, Sandeep Chandril, Kineshma Munbodh, Trent Johnson, Jackeline Queen, Cameron Keenan (with T. Myers)—West Virginia University; Esteban Ramos-Moore (with A. Cabrera)—Universidad Católica de Chile; Eduardo Delgado (with P. Prieto)—Universidad del Valle, Colombia

**M. S. Thesis Advisor:** Erie Morales, Jason Francis—West Virginia University

**Postgraduate-Scholar Sponsor:** Hongtao Shi, Zhonghyan Liu, Yewhee Chye, Miyeon Cheon, Jianhua Gu, Odille Myers, Felio A. Perez—West Virginia University

**Number of graduate students advised:** 13

**Number of postdoctoral scholars sponsored:** 7

## Biographical Sketch

### James P. Lewis, Ph. D.

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### a. Professional Preparation

Arizona State University	Physics/Mathematics	B. S. 1990
Arizona State University	Physics	Ph. D. 1996
University of North Carolina	Biochemistry	1996-1998
Duke University	Chemistry	1996-1998
		Postdoctoral Research

### b. Appointments

2009-present	Associate Chair, Department of Physics, West Virginia University
2006-present	Associate Professor, Department of Physics, West Virginia University
2004-2006	Assistant Professor, Department of Physics/Astronomy, Brigham Young University
2001-2004	Research Assistant Professor, Department of Physics/Astronomy, Brigham Young University
1998-2001	Research Assistant Professor, Department of Chemistry, University of Utah

### c. Publications

#### (i) Publications most closely related to proposal

Wang, J., Tafen, D. N., Lewis, J. P., Hong, Z., Manivannan, A., Zhi, M., et al. (in press). Origin of the photocatalytic activity of nitrogen-doped TiO<sub>2</sub> nanobelts. *Journal of the American Chemical Society*.

Tafen, D., & Lewis, J. P. (2009). Structure, stability, and electronic properties of thin TiO<sub>2</sub> nanowires. *Physical Review B*, 80, 014104.

Tafen, D., Wang, J., Wu, N., & Lewis, J. P. (2009). Photocatalytic activity in nitrogen-doped TiO<sub>2</sub> nanowires. *Applied Physics Letters*, 94, 093101.

Wang, H., Gannett, P., Cheatham, T. E., III, & Lewis, J. P. (2008). Differential electronic states observed during the A-B DNA duplex conformational transitions. *Soft Matters*, 5, 685-690.

Jelínek, P., Wang, H., Lewis, J. P., Sankey, O. F., & Ortega, J. (2005). Multi-center approach to the exchange-correlation interactions in *ab-initio* tight-binding methods. *Physical Review B*, 71, 235101.

#### (ii) Other publications

Junkermeier, C. E., Bryant, G. W., & Lewis, J. P. (2008). Ab initio tight-binding analysis of CdS nanocrystals. *Physical Review B*, 71, 205125.

Keith, J. B., Wang, H., & Lewis, J. P. (2008). Ab initio free energy of vacancy formation and mass-action kinetics in vis-active TiO<sub>2</sub>. *Journal of Physics: Condensed Matter* [Fast Track], 20, 022202.

Wang, H., & Lewis, J. P. (2005). Effects of dopant states on photoactivity in carbon-doped TiO<sub>2</sub>. *Journal of Physics: Condensed Matter*, 17, L209-L213.

Wang, H., Lewis, J. P., & Sankey, O. F. (2004). Band-gap tunneling states in DNA. *Physical Review Letters*, 93, 016401-1.

Lewis, J. P., Glaesemann, K. R., Voth, G. A., Fritsch, J., Demkov, A. A., Ortega, J., et al. (2001). Further developments in the local-orbital density functional theory tight-binding method: FIREBALL. *Physical Review B*, 64, 195103.

#### **d. Synergistic Activities**

1. Faculty mentor, Student Undergraduate Research Experience (SURE)—role included mentoring WVU undergraduate student and guiding a WVU graduate student in mentoring of undergraduate research, 2007-
2. Teragrid Committee, reviewer and sitting member on committee which oversees allocations for Teragrid proposals, 2007-
3. Organizer for WVNano International Symposium on Multifunctional Materials (includes heavy undergraduate participation), annual
4. Mentor, 6 undergraduate students (current)

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Y. Bai	Jilin University, China	P. Jelinek	Czech Academy of Sciences
G. Bryant	Nat'l Inst. Science & Tech.	J. K. Johnson	Univ. of Pittsburgh
T. E. Cheatham, III	University of Utah	D. Keffer	Univ. of Tennessee
R. Davis	Brigham Young Univ.	R. Lake	Univ. of CA-Riverside
J. Dong	Auburn University	C. Li	Dalian Inst. of Chemical Physics, China
D. Drabold	Ohio University	D. Nicholson	Oak Ridge Nat'l Lab.
B. Edwards	Univ. of Tennessee	J. Ortega	Univ. Autonoma de Madrid
F. Flores	Univ. Autonoma de Madrid	K. Sikorski	University of Utah
J. Fucelli	University of Utah	H. Stokes	Brigham Young Univ.
M. Fuentes-Cabrerra	Oak Ridge Nat'l Lab.	T. N. Truong	University of Utah
D. Hatch	Brigham Young Univ.		
B. C. Hess	Brigham Young Univ.		

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisor:** Otto F. Sankey—Arizona State University

**Postdoctoral Sponsor:** Gregory A. Voth—University of Utah; Weitao Yang—Duke University; Jan Hermans—University of North Carolina

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Ph. D.: C. E. Junkermeier, S. Spellman, B. Haycock, T. Kline—WVU; M. S.: E. Mendez—WVU

**Postgraduate-Scholar Sponsor:** J. B. Keith—CalTech; O. Khorgulkuu, D. Tafen—NETL; Hao Wang, Hong Wang—WVU

**Number of graduate students advised: 8**

**Number of postdoctoral scholars sponsored: 5**

## Biographical Sketch

### Bingyun Li, Ph. D.

HSC 3943  
Department of Orthopaedics  
West Virginia University  
Morgantown, WV 26506-9196

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E-mail: bli@hsc.wu.edu

#### a. Professional Preparation

Central South University, China	Materials Science and Engineering	B.S. 1994
Chinese Academy of Sciences	Materials Science	M.S. 1997
Chinese Academy of Sciences	Biomaterials Science	Ph.D. 2000
University of Notre Dame	Chemical Engineering	2000-2002
Louisiana Tech University	Nanotechnology and Protein Engineering	2002-2005 Postdoctoral Research

#### b. Appointments

2005-present	Assistant Professor, Department of Orthopaedics, West Virginia University
2005-present	Faculty Participant, WVNano Initiative, West Virginia University
2006-present	Faculty Participant, Drug Discovery and Therapeutics Group, West Virginia University
2006-present	Adjunct Assistant Professor, Department of Chemical Engineering, West Virginia University
2006-present	Director, Biomaterials, Bioengineering and Nanotechnology Laboratory, West Virginia University
2007-present	Guest Researcher, National Institute for Occupational Safety and Health (NIOSH), Center for Disease Control and Prevention, Morgantown, WV
2007-present	Institute Fellow, National Energy Technology Laboratory-Institute for Advanced Energy Solutions (NETL-IAES)

#### c. Publications

##### (i) Publications most closely related to proposal

Li, B., Jiang, B., Boyce, B., & Lindsey, B. (2009). Multilayer polypeptide nanoscale coatings for the prevention of biomedical device associated infections. *Biomaterials*, 30, 2552.

Jiang, B., & Li, B. (2009). Tunable drug incorporation and release from polypeptide multilayer nanofilms. *International Journal of Nanomedicine*, 4, 37.

Jiang, B., & Li, B. (2009). Polypeptide nanotechnology coatings for preventing dental and orthopaedic device-associated infection. *Journal of Biomedical Materials Research*, 88B(2), 332.

Li, B., Jiang, B., Dietz, M. J., Smith, E. S., Clovis, N. B., & Rao, K. M. K. (2009, May). Evaluation of local MCP-1 and IL-12 nanocoatings for infection prevention in open fractures. *Journal of Orthopedic Research* (Epub). Available at <http://www3.interscience.wiley.com/cgi-bin/fulltext/122505606/PDFSTART>

Likibi, F., Jiang, B., & Li, B. (2008). Biomimetic nanocoating promotes osteoblast cell adhesion on biomedical implants. *Journal of Materials Research*, 23(12), 3222.

##### (ii) Other publications

Zhao, Q., & Li, B. (2008). pH-controlled drug loading and release from biodegradable microcapsules. *Nanomedicine: Nanotechnology, Biology, and Medicine*, 4(4), 302.

Li, B., Rozas, J., & Haynie, D. T. (2006). Structural stability of polypeptide nanofilms under extreme conditions. *Biotechnology Progress*, 22(1), 111.

Zhong, Y., Li, B., & Haynie, D. T. (2006). Control of stability of polypeptide multilayer nanofilms by quantitative control of disulfide bond formation. *Nanotechnology*, 17, 5726.

Li, B., Haynie, D. T., Palath, N., & Janisch, D. (2005). Nano-scale biomimetics: Fabrication and optimization of stability of peptide-based thin films. *Journal of Nanoscience and Nanotechnology*, 12(5), 2042.

Li, B., & Haynie, D. T. (2004). Multilayer biomimetics: Reversible covalent stabilization of a nanostructured biofilm. *Biomacromolecules*, 5(5), 1667.

#### **d. Synergistic Activities**

1. NSF Fellow, NSF Summer Institute on Nano Mechanics and Materials, 2007
2. Member Society for Biomaterials, Orthopaedic Research Society, Materials Research Society
3. Invited speaker and panelist, Cool Tech Nanomedicine event (Northern Virginia Technology Council), McLean, Virginia, November 2008
4. Symposium chair and organizer, "Biomimetics and nanoscience: advances in protein/peptide-based biomaterials," Society for Biomaterials 2007 Annual Meeting
5. Proposal reviewer, NSF, Department of Energy (DoE), U.S. Civilian Research and Development Foundation, Louisiana Board of Regents, Jeffress Memorial Trust, American Chemical Society Petroleum Research Fund; journal reviewer, *Journal of Nanoscience and Nanotechnology*, *Nanomedicine*, *International Journal of Biomedical Nanoscience and Nanotechnology*, *Recent Patents on Nanotechnology*, *Journal of Biomedical Nanotechnology*, *Biomaterials*, *Biomacromolecules*, *Acta Biomaterialia*, *Journal of Biomedical Materials Research*, *Open Biomaterials Journal*, *Langmuir*, *Advanced Science Letters*, *European Polymer Journal*, *Materials Science and Engineering C*, *Energy & Fuels*

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

J. B. Barnett	WVU
S. E. Emery	WVU
M. Gray	NETL
Y. Qian	NIOSH
K. M. K. Rao	NIOSH
J. G. Thomas	WVU

##### **(ii) Graduate and Postdoctoral Advisors**

<b>Graduate Advisors:</b>	Y. Y. Li and L. J. Rong	Chinese Academy of Sciences, China
<b>Postdoctoral Advisor:</b>	A. Varma	University of Notre Dame
<b>Postdoctoral Advisor:</b>	D. T. Haynie	South Florida University

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

###### **Thesis Advisor:**

Ph.D. Student: Therwa Hamza—WVU

M.S. Students: Heather Ogle, Shanny Shi, Elizabeth DeFusco, Brian Kellermeyer, Michael Hagar, Stephanie Knittle, Steven Regal, Adly Noore—WVU

###### **Postgraduate-Scholar Sponsor:**

Hongshuai Li, Bingbing Jiang, Qinghe Zhao, and Likibi Fidele—WVU

**Total number of graduate students advised: 9**

**Total number of postdoctoral scholars sponsored: 4**



## Biographical Sketch

### Yuxin Liu, Ph. D.

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Electrical Engineering  
P.O. Box 6109  
West Virginia University  
Morgantown, WV 26506-6109

**Phone:** 304.293.9144

**E-mail:** yuxin.liu@mail.wvu.edu

### a. Professional Preparation

Beijing Institute of Technology	Electrical Engineering	B.S. 1996 (with honors)
Changchun University of Science And Technology	Electrical Engineering	M.S. 2000
Louisiana Tech University	Engineering	Ph.D. 2003

### b. Appointments

2009-present	Assistant Professor, Lane Department of Computer Science and Electrical Engineering, West Virginia University
2009	Research Assistant Professor, Department of Biomedical Engineering, Vanderbilt University
2004-2009	Research Associate, Department of Physics and Astronomy, Vanderbilt University
2004	Postdoctoral Associate, Department of Food Science, Cornell University

### c. Publications

#### (i) Publications most closely related to proposal

Liu, Y., Sai, J., Richmond, A., & Wikswow, J. (2008). Microfluidic switching system for analyzing Wortmannin inhibited HL-60 cells chemotaxis responses. *Biomedical Microdevices*, 10, 499-507.

Sai, J., Raman, D., Liu, Y., Wikswow, J., & Richmond, A. (2008). Parallel PI3K-dependent and src-dependent pathway lead to CXCL8-mediated rac2 activation and chemotaxis. *Journal of Biological Chemistry*, 283(39), 26538-26547.

Liu, Y., Cady, N., & Batt, C. (2007). A plastic microchip for nucleic acid purification. *Biomedical Microdevices*, 9(5), 769-776.

#### (ii) Other publications

Liu, Y., & Cui, T. (2005). Integrated an AC follower circuit with a polymeric JFET and ink-jet printed resistors as active devices. *Solid State Electronics*, 49, 445-448.

Liu, Y., & Cui, T. (2005). Electrical characterization of MOS capacitors based on layer-by-layer self-assembly technique. *Journal of Nanoscience and Nanotechnology*, 5, 192-197.

Liu, Y., & Cui, T. (2004). Fabrication and characterization of polymeric P-channel junction field effect transistor. *IEEE Transaction on Electron Devices*, 51(3), 389-393.

Liu, Y., Cui, T., Sunkam, R. K., Coane, P. J., Vasile, M., & Geoertter, J. (2003). Novel approach to form and pattern sol-gel polymethylsilsesquioxane-based spin-on glass thin and thick films. *Sensors and Actuators B: Chemical*, 88, 75-79.

Liu, Y., Cui, T., Coane, P. J., Vasile, M., & Geoertter, J. (2003). High-aspect-ratio microstructures fabricated by X-ray lithography of polymethylsilsesquioxane-based spin-on glass thick films. *Microsystem Technologies*, 9(3), 171-175.

**d. Synergistic Activities**

1. Excellence in Research and Scholarly Activity Award, Institute for Micromanufacturing, Louisiana Tech University, 2002
2. Member, Biomedical Engineering Society, IEEE

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

J. Wikswo                      Vanderbilt University  
T. Cui                              University of Minnesota

**(ii) Graduate and Postdoctoral Advisors**

<b>Graduate Advisor:</b>	Prof. T. Cui	University of Minnesota
<b>Postdoctoral Advisors:</b>	Prof. J. Wikswo	Vanderbilt University
	Prof. C. Batt	Cornell University

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** none

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** none

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Slawomir Lukomski, Ph. D.

Department of Microbiology  
P. O. Box 9177  
West Virginia University  
Morgantown, WV 26506

Phone: 304.293.6405

E-mail: slukomski@hsc.wvu.edu

### a. Professional Preparation

University of Lodz, Poland	Microbiology	M. S. 1983
University of Lodz, Poland	Microbial Pathogenesis	Ph. D. 1990
IBT, Texas A&M University	Biochemistry	1993
Baylor College of Medicine	Microbial Pathogenesis	1997
		Postdoctoral Research

### b. Appointments

2003-present Associate Professor, Department of Microbiology, Immunology, and Cell Biology, Mary Babb Randolph Cancer Center, West Virginia University School of Medicine

1997-2003 Research Assistant Professor, Baylor College of Medicine

1996-1997 Research Associate, Baylor College of Medicine (with Dr. James M. Musser)

1994-1996 Research Associate, Baylor College of Medicine (with Dr. Sheila I. Hull)

1990 Visiting Fellow, University of Wisconsin-Madison

1990-1993 Postdoctoral Fellow, University of Alabama-Birmingham and Texas A&M University (with Dr. Robert D. Wells)

1987-1988 Visiting Fellow, Forschungsinstitut, Borstel, Germany

### c. Publications

#### (i) Publications most closely related to proposal

- Caswell, C. C., Oliver-Kozup, H., Han, R., Lukomska, E., & Lukomski, S. (in press). Scl1, the multifunctional adhesin of group A *Streptococcus* binds cellular fibronectin and laminin and mediates pathogen internalization by human cells. *FEMS Microbiology Letters*.
- Leski, T. A., Caswell, C. C., Pawlowski, M., Klinke, D. J., Bujnicki, J. M., Lukomski, S., et al. (in press). *bcl* genes of *Bacillus cereus* group organisms: Identification, classification and application in *Bacillus anthracis* detection and fingerprinting. *Applied and Environmental Microbiology*.
- Caswell, C. C., Barczyk, M., Keene, D. R., Lukomska, E., Gullberg, D. E., & Lukomski, S. (2008). Identification of the first prokaryotic collagen-sequence motif that mediates binding to human collagen receptors, integrins  $\alpha_2\beta_1$  and  $\alpha_{11}\beta_1$ . *Journal of Biological Chemistry*, 283, 36168-36175.
- Mohs, A., Silva, T., Yoshida, T., Lukomski, S., Inouye, M., & Brodsky, B. (2007). Alternative mechanism of stabilization of a bacterial collagen triple-helix in absence of hydroxyproline. *Journal of Biological Chemistry*, 282, 29757-29765.
- Han, R., Zwiefka, A., Caswell, C. C., Xu, Y., Keene, D. R., Lukomski, S., et al. (2006). Assessment of prokaryotic collagen-like sequences derived from streptococcal Scl1 and Scl2 proteins as a source of recombinant GXY polymers. *Applied Microbiology and Biotechnology*, 72, 109-115.

## ii) Other publications

Caswell, C. C., Han, R., Hovis, K. M., Lukomska, E., Ciborowski, P., Lukomski, S., et al. (2008). The Scl1 protein of M6-type group A *Streptococcus* binds the human complement regulatory protein, factor H, and inhibits the alternative pathway of complement. *Molecular Microbiology*, 67, 584-596.

Caswell, C. C., Lukomska, E., Seo, N.-S., Höök, M., & Lukomski, S. (2007). Scl1-dependent internalization of group A *Streptococcus* via direct interactions with the  $\alpha_2\beta_1$  integrin enhances pathogen survival and reemergence. *Molecular Microbiology*, 64, 1319-1331.

Påhlman, L. I., Marx, P. F., Mörgelin, M., Lukomski, S., Meijers, J. C. M., & Herwald, H. (2007). Thrombin activatable fibrinolysis inhibitor binds to *Streptococcus pyogenes* by interacting with collagen-like proteins A and B. *Journal of Biological Chemistry*, 282, 24873-24881.

Zwiefka, A., Palzkill T., Han, R., Lukomska, E., Wojciechowski, J., & Lukomski, S. (2006). Combinatorial search for the ligands that specifically recognize the streptococcal collagen-like proteins Scl1 and Scl2. *International Congress Series*, 1289, 207-210.

Han, R., Caswell, C. C., Lukomska, E., Keene, D. R., Pawlowski, M., Lukomski, S., et al. (2006). Binding of the low density lipoprotein by streptococcal collagen-like protein Scl1 of *Streptococcus pyogenes*. *Molecular Microbiology*, 61, 351-367.

## d. Synergistic Activities

1. Member, American Society for Microbiology, American Association for the Advancement of Science, American Society for Biochemistry and Molecular Biology
2. Mentor of 3 WV IDeA network of Biomedical Research Excellence students

## e. Collaborators and Other Affiliations

### (i) Collaborators and Co-Editors

B. Brodsky	University of Medicine and Dentistry of New Jersey
J. M. Bujnicki	Int'l Institute of Molecular and Cell Biology, Warsaw, Poland
D. Gullberg	University of Bergen, Norway
S. J. Hart	Naval Research Laboratory
H. Herwald	Lund University, Sweden
M. Höök	IBT/TAMU HSC
R. T. Marconi	Medical College of Virginia at Commonwealth University
S. D. Reid	Wake Forest University
P. Speziale	University of Pavia, Italy
P. Zipfel	Friedrich-Schiller University, Jena, Germany

### (ii) Graduate Advisors and Postdoctoral Sponsors

**Graduate Advisor:** A. Jaworski—University of Lodz

**Postdoctoral Sponsor:** R. D. Wells—IBT/TAMU HSC; J. M. Musser—Baylor College of Medicine

### (iii) Thesis Advisor and Postgraduate-Scholar Sponsor

**Thesis Advisor:** Ph. D. students: C. C. Caswell, H. A. Oliver-Kozup—WVU; M. S. students: J. Dziadek, M. Pytlos, P. Staczek, M. Sawicka, K. Kubiak—University of Lodz

**Postgraduate-Scholar Sponsor:** C. Edward Ebert, Runlin Han, Antoni Zwiefka—WVU; Kazumitsu Nakashima—Baylor College of Medicine

**Number of graduate students advised:** 7

**Number of postdoctoral scholars sponsored:** 4

## Biographical Sketch

**Paul Miller, Ph. D.**  
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West Virginia University  
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Morgantown, WV 26506

**Phone:** 304.293.3422  
**E-mail:** paul.miller@mail.wvu.edu

### a. Professional Preparation

University of Wyoming	Physics	B.S. 1991 (with honors)
University of Michigan	Physics	M.S. 1993
University of Wyoming	Secondary Science Education/ Chemistry Minor	B.A. 1995
West Virginia University	Physics	Ph.D. 2009

### b. Appointments

2009-present	Visiting Assistant Professor, Physics Department, West Virginia University
2001-2007	Science Teacher, University High School, Morgantown, West Virginia
1997-2001	Science Teacher, Northern Garrett High School, Accident, Maryland
1997-2001	Director, National Youth Science Camp, West Virginia
1995-1997	Science Teacher, Roseburg High School, Roseburg, Oregon

### c. Publications

#### (i) Publications most closely related to proposal

none

#### (ii) Other publications

Clauer, C. R., Stauning, P., Rosenberg, T. J., Friis-Christensen, E., Miller, P. M., & Sitar, R. J. (1995).  
Observations of a solar-wind-driven modulation of the dayside ionospheric *DPY* current system.  
*Journal of Geophysical Research*, 100 (A5), 7697-7713.

### d. Synergistic Activities

1. Physics department representative on West Virginia University's math and science educators team, including joining the in-progress TEACH-WV Robert Noyce Teacher Scholarship program, 2009-
2. Teacher participant in NSF research experience for teachers program, transferring knowledge and perspective gained during summer work in a physics lab to my students in the secondary science classroom, 2003-2007
3. Director of the National Youth Science Camp, an annual month-long summer program that hosts two graduating high school seniors per state in the mountains of West Virginia; students are selected based on their achievement in the STEM fields and attend free of charge, 1997-2001
4. Maryland State Science Content Standards team member, 1997-1999

### e. Collaborators and Other Affiliations

#### (i) Collaborators and Co-Editors

H. Gunell	West Virginia University
M. E. Koepke	West Virginia University

#### (ii) Graduate Advisors and Postdoctoral Sponsors

**Graduate Advisors:** Ph.D.: M. Koepke—West Virginia University; M.S.: C. R. Clauer—Virginia Tech  
**Postdoctoral Sponsor:** none

#### (iii) Thesis Advisor and Postgraduate-Scholar Sponsor

**Thesis Advisor:** none

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** none

**Number of postgraduate scholars sponsored:** none

## Biographical Sketch

### Michael Lewis Norton, Ph. D.

478 Science Hall  
Marshall University  
1 John Marshall Drive  
Huntington, WV 25755

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E-mail: norton@marshall.edu

### a. Professional Preparation

Louisiana State University-Shreveport	Chemistry	B. S. 1977
Arizona State University	Solid State Chemistry	Ph. D. 1982
Naval Weapons Center, China Lake, CA	Electronic Materials	1982-1984 NRC Postdoctoral Fellow

### b. Appointments

1995-present	Professor of Chemistry, Marshall University
1991-1995	Associate Professor of Chemistry, Marshall University
1984-1991	Assistant Professor of Chemistry, Marshall University

### c. Publications

#### (i) Publications most closely related to proposal

Shen, W., Zhong, H., Neff, D., & Norton, M. L. (2009). NTA directed protein nanopatterning on DNA origami nanoconstructs. *Journal of the American Chemical Society*, 131(19), 6660–6661.

Norton, M., Day, B. S., Cao, H., Rahman, M., & Gin, A. (2008). Arrays of nanoarrays: Elements of binding. *IEEE Sensors Journal*, 8(6), 874-879.

Norton, M. (2007). Designed self-organization for molecular optoelectronic sensors. *International Journal of High Speed Electronics and Systems*, 17(2), 311-326.

Rice, K. M., Preston, D. L., Neff, D., Norton, M., & Blough, E. R. (2006). Age-related dystrophin-glycoprotein complex structure and function in the rat extensor digitorum longus and soleus muscle. *Journals of Gerontology A: Biological Sciences and Medical Sciences*, 61(11), 1119-29.

Rahman, M., Day, B. S., Cao, H., Butts, H., & Norton, M. (2006). Ordered DNA arrays prepared via soft lithography. In N. K. Dhar, A. K. Dutta, & M. S. Islam (Eds.), *Nanomaterial synthesis and integration for sensors, electronics, photonics, and electro-optics. Proceedings of SPIE*, 637012.1-637012.9.

#### (ii) Other publications

Bellido, E. P., Bobadilla, A. D., Rangel, N. L., Zhong, H., & Norton, M. L., & Sinitskii, A., et al. (2009). Current-voltage-temperature characteristics of DNA origami. *Nanotechnology*, 20, 175102.

Bobadilla, A.D., Bellido, E. P., Rangel, N. L., Zhong, H.; Norton, M., & Sinitskii, A., et al. (2009). DNA origami impedance measurement at room temperature. *Journal of Chemical Physics*, 130, 171101; (2009), *Virtual Journal of Nanoscale Science and Technology*, 19(20): Organic-Inorganic Hybrid Nanostructures; (2009, May 15), *Virtual Journal of Biological Physics Research*. Available at <http://www.virtualjournals.org/vjs/>

Hong, S., Jauregui, L. A., Rangel, N. L., Cao, H., Day, B. S., Norton, M. L., et al. (2008). Impedance measurements on a DNA junction. *Journal of Chemical Physics*, 128(20), 201103-201106.

Santagata, N. M., Pengshun, L., Lakhani, A. M., DeWitt, D. J., Day, B. S., Norton, M. L., et al. (2008). Organizational structure and electronic decoupling of surface bound chiral domains and biomolecules. *IEEE Sensors Journal*, 8(6), 758-766.

Vaidya, A. A., & Norton, M. L. (2004). DNA attachment chemistry at the flexible silicone elastomer surface: Toward disposable microarrays. *Langmuir*, 20(11), 100-107.

#### **d. Synergistic Activities**

1. Teaching innovations and service: developed low cost stereo projection system for classroom use; direct Molecular and Biological Imaging Center (<http://www.marshall.edu/mbic/>, which houses instrumentation for SEM, Confocal, and Scanned Probe methods); consultant, facilities for high school, undergraduate, as well as graduate student use
2. Founding member for a DNA mass production company:  
<http://www.vandaliaresearch.com/about.asp>
3. Inventor and consultant for novel solid state lamp systems:  
<http://www.ecer.area125.com/main3.html>
4. National service: regularly participate in NSF, DOD, and PRF (ACS) proposal reviews
5. Broadening science participation: oversee the Marshall University Summer Undergraduate Research Program; mentor an average of 4 high school and 5 undergraduate researchers per year

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators**

S. Armentrout	Parabon	T. Globus	Univ. of Virginia
S. Barke	Univ. of Virginia	D. Lederman	West Virginia Univ.
E. Blough	Marshall Univ.	R. Niles	Marshall Univ.
E. Brown	UC-Santa Barbara	N. Seeman	New York Univ.
S. Brueck	Univ. of New Mexico	J. Seminario	Texas A&M
N.-S. Chong	Middle Tenn. St. Univ.	C. Somerville	Marshall Univ.
C. Dwyer	Duke Univ.	J. Stickney	Univ. of Georgia
B. Belmont	Univ. of Virginia	J. Switzer	Univ. of Missouri-Rolla
P. Georgel	Marshall Univ.	A. Timperman	West Virginia Univ.
A. Gin	CINT		

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisors:** Robert Von Dreele (LAN/Argonne), William Glaunsinger (Arizona State University)

**Postdoctoral Sponsor:** Robert Schwartz (Naval Weapons Center)

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Mentored at Marshall University—Sirintorn Klinsukont, Ming Liang (NIH), Melanie Wolfe (Pfizer), Duy Bao Dinh, Brian Baker (Special Metals), Farrah Boggess (WV State Police), Fan Zhang, Aoune Barhoumi, (Rice), Thabo Gcwabaza (Univ. of Kentucky), Anuradha Rajulapati (current), Dawn Nicholas (current)

**Postgraduate-Scholar Sponsor:** Hong Zhong (NYU—current), Masudur Rahman (Japan—current), Wanqiu Shen (NYU), Brian Scott Day (Virginia Tech), Maryna Lvovska (Ukraine), Chris Meadows (Purdue), Mashiur Rahman (Bangladesh), Ashish Vaidya (India), Ava Dykes (Univ. of Hawaii), Chad Huffman (ManTech International)

**Number of graduate students advised: 11**

**Number of postdoctoral scholars sponsored: 10**



## Biographical Sketch

### F. Robin O'Keefe, Ph. D.

Science Building S267  
Marshall University  
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Huntington, WV 25755

**Phone:** 304.696.2427

**E-mail:** okeefef@marshall.edu

### a. Professional Preparation

Stanford University  
University of Chicago  
New York College of  
Osteopathic Medicine

Biology  
Evolutionary Biology  
Anatomy

B.S. (Honors) 1992  
Ph. D. 2000  
2000-2001  
Postdoctoral Research

### b. Appointments

2009-present	Associate Professor, Department of Biology, College of Science, Marshall University
2006-2009	Assistant Professor, Department of Biology, Marshall University
2004-2006	Course Coordinator, Human Anatomy, New York College of Osteopathic Medicine
2001-1006	Assistant Professor, Department of Anatomy, New York College of Osteopathic Medicine
1996-1999	Teaching Assistant, University of Chicago
1992-1995	Textbook Editor, Addison-Wesley Publishing Company
1990-1992	Teaching Assistant, Stanford University

### c. Publications

#### (i) Publications most closely related to proposal

O'Keefe, F. R., Fet, E. V., & Harris, J. M. (in press). Compilation, calibration, and synthesis of faunal and floral radiocarbon dates, Rancho La Brea, California. *Contributions in Science, Los Angeles County Museum of Natural History*.

O'Keefe, F. R., & Carrano, M. T. (2005). Correlated trends in the evolution of the plesiosaur locomotor system. *Paleobiology*, 31(4), 656-675.

Sidor, C. A., O'Keefe, F. R., Damiani, R., Steyer, J. S., Smith, R. M. H., Larsson, H. C. E., et al. (2005). Permian tetrapods from the Sahara show climate-controlled endemism in Pangea. *Nature*, 434, 886-889.

O'Keefe, F. R., & Wagner, P. J. (2001). Inferring and testing hypotheses of cladistic character dependence using character compatibility. *Systematic Biology*, 50(5), 657-675.

O'Keefe, F. R., Rieppel, O., & Sander, P. M. (1999). Shape disassociation and inferred heterochrony in a clade of pachypleurosaur (Reptilia, Sauropterygia). *Paleobiology*, 25(4), 504-517.

#### (ii) Other publications

O'Keefe, F. R., Sidor, C. A., Larsson, H. C. E., Maga, A., & Ide, O. (2006). Evolution and homology of the astragalus in early amniotes: New fossils, new perspectives. *Journal of Morphology*, 267, 415-425.

O'Keefe, F. R., Sidor, C. A., Larsson, H. C. E., Maga, A., & Ide, O. (2005). The vertebrate fauna of the Upper Permian of Niger— III. Morphology and ontogeny of the hindlimb of *Moradisaurus grandis* (Reptilia, Captorhinidae, Moradisaurinae) from the Upper Permian of Niger. *Journal of Vertebrate Paleontology*, 25(2), 309-319.

O'Keefe, F. R. (2001). Ecomorphology of plesiosaur flipper geometry. *Journal of Evolutionary Biology*, 14(6), 987-991.

O'Keefe, F. R. (2002). The evolution of plesiosaur and pliosaur morphotypes in the Plesiosauria (Reptilia: Sauropterygia). *Paleobiology*, 28(1), 101-112.

O'Keefe, F. R., & Sander, P. M. (1999). Paleontological paradigms and inferences of phylogenetic pattern: A case study. *Paleobiology*, 25(4), 518-533.

#### **d. Synergistic Activities**

1. Assistant editor, *Journal of Vertebrate Paleontology*, 2007-
2. Scientific advisor, Discovery Channel, National Geographic Magazine, and IMAX films, reviewing and appearing in print, web, and film content, 2003-
3. Anatomy course coordinator, developed and administrated new, integrated lecture and laboratory curriculum for over 300 first-year medical students, 2004-2006
4. SVP program committee member, responsible for reviewing  $\approx$  500 abstracts a year for Society of Vertebrate Paleontology annual meeting, as well as program review and organization, 2003-2008
5. African field work, senior participant in paleontological expeditions to Madagascar and Niger, including scientific, educational, and medical outreach, 2002, 2003

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Buckley, G.	Roosevelt University
Carrano, M.	Smithsonian Institution
Damiani, R.	Staatliches Museum Für Naturkunde, Germany
Head, J.	University of Toronto at Mississauga, Canada
Hiller, N.	Canterbury Museum, New Zealand
Ide, O.	Institut de Recherches en Sciences Humaines, Niger Republic
Larsson, H. C. E.	McGill University, Canada
Maga, A.	Institut de Recherches en Sciences Humaines, Niger Republic
Massare, J.	SUNY Brockport
Sato, T.	National Science Museum, Tokyo
Sereno, P. C.	University of Chicago
Sidor, C. A.	University of Washington
Smith, R. M. H.	South African Museum, South Africa
Steyer, J. S.	CNRS-MNHN, France

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Graduate Advisors:</b>	Hopson, J. A.	University of Chicago
	LaBarbera, M.	University of Chicago
	Rieppel, O.	Field Museum of Natural History
	Wagner, P. J.	Smithsonian Institution
<b>Postdoctoral Sponsors:</b>	Solounias, N.	New York College of Osteopathic Medicine

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

<b>Thesis Advisor:</b>	Street, H. P.	Marshall University
	Wilhelm, B.	Marshall University
	Richards, C.	Marshall University
	Hzu, H.	Marshall University
	Holloway, W.	Marshall University

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 1 finished, 4 current

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Elmer M. Price, Ph.D.

BBSC 241S  
Marshall University  
1 John Marshall Drive  
Huntington, WV 25755

**Phone:** 304.696.3611

**E-Mail:** pricee@marshall.edu

### a. Professional Preparation

Northern Kentucky University  
University of Cincinnati  
University of Cincinnati

Chemistry  
Biochemistry  
Molecular Biology

B.S. 1983  
Ph.D. 1987  
Postdoctoral studies 1987-1990

### b. Appointments

2009-present Chair, Department of Biology, College of Science, Marshall University  
2007-Present Professor (tenured), Department of Biology, College of Science, Marshall University  
2007-Present Director, Cell Differentiation and Development Center, Byrd Biotechnology Science Center, Marshall University  
2004-2006 Interim Director, Dalton Cardiovascular Research Center, University of Missouri-Columbia  
2003-2006 Associate Director, Dalton Cardiovascular Research Center, University of Missouri-Columbia  
1998-2007 Associate Professor (tenured), Department of Biomedical Sciences, College of Veterinary Medicine, University of Missouri-Columbia  
1993-2007 Research Investigator, Dalton Cardiovascular Research Center, University of Missouri-Columbia  
1993-1998 Assistant Professor, Department of Biomedical Sciences, College of Veterinary Medicine, University of Missouri-Columbia  
1990-1993 Assistant Professor, Department of Pharmacology, College of Medicine, University of North Carolina at Chapel Hill

### c. Publications

#### (i) Publications most closely related to proposal

- Jankord, R., Turk, J. R., Schadt, J. C., Casati, J., Ganjam, V. K., Price, E. M., et al. (2007). Sex difference in link between interleukin-6 and stress. *Endocrinology*, 148(8), 3758-3764.
- Ingram, D. G., Newcomer, S. C., Price, E. M., Eklund, K. E., McAllister, R. M. and Laughlin, M. H. (2007). Chronic nitric oxide synthase inhibition blunts endothelium-dependent function of conduit coronary arteries, not arterioles. *American Journal of Physiology: Heart and Circulatory Physiology*, 292(6), H2798-2808.
- Price, E. M., Prather R. S., & Foley, C. M. (2006). Multipotent adult progenitor cell lines originating from the peripheral blood of green fluorescent protein transgenic swine. *Stem Cells and Development* 15(4), 507-522.
- McAllister, R. M., Albarracin, I., Jasperse, J. L., & Price, E. M. (2005). Thyroid status and endothelium-dependent vasodilation in skeletal muscle. *American Journal of Physiology: Regulatory Integrative & Comparative Physiology*, 288(1), R284-R291.
- Clarke, L. L., Gawenis, L. R., Hwang, T. C., Walker, N. M., Gruis, D. B., & Price, E. M. (2004). A domain mimic increases  $\Delta F508$  CFTR trafficking and restores CAMP-stimulated anion secretion in cystic fibrosis epithelia. *American Journal of Physiology: Cell Physiology*, 287(1):C192-199.

**(ii) Other publications**

Bowles, D. K., Heaps, C. L., Turk, J. R., Maddali, K. K., & Price, E. M. (2004). Hypercholesterolemia inhibits L-type calcium current in coronary macro-, not microcirculation. *Journal of Applied Physiology*, 96(6), 2240-2248.

Laughlin, M. H., Turk, J. R., Schrage, W. G., Woodman, C. R., & Price, E. M. (2003). Influence of coronary artery diameter on eNOS protein content. *American Journal of Physiology: Heart & Circulatory Physiology*, 284(4): H1307-12.

Foley, C. M., Stanton, J. J., Price, E. M., Cunningham, J. T., Hasser, E. M., & Heesch, C. M. (2003). GABA(A)  $\alpha$ 1 and  $\alpha$ 2 receptor subunit expression in rostral ventrolateral medulla in nonpregnant and pregnant rats. *Brain Research*. 975(1-2): 196-206.

Laughlin, M. H., Pollock, J. S., Amann, J. F., Hollis, M. L., Woodman, C. R., Price, E. M. (2001). Training induces nonuniform increases in eNOS content along the coronary arterial tree. *Journal of Applied Physiology*, 90(2): 501-10.

**d. Synergistic Activities**

1. Authored many papers describing novel discoveries such as the molecular basis of the benefits of exercise and the identification of adult multipotent stem cells
2. Trained several individuals who themselves have made significant contributions to science as professors
3. Consistently excels in teaching, receiving outstanding student evaluations; developed a course titled "Multidisciplinary Approaches to Biomedical Research," which became a required graduate course at the University of Missouri
4. Values talking to young students and participates in tours and community events involving K-12 students

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

E. Blough	Marshall University	C. Heaps	Texas A&M
D. Bowles	University of Missouri	H. Laughlin	University of Missouri
J. Mueller-Delp	West Virginia University	R. McAllister	University of Missouri
P. Georgel	Marshall University	R. Prather	University of Missouri

**(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Graduate Advisor:</b>	James H. Freisheim, Ph.D.	University of Cincinnati (retired)
<b>Postdoctoral Sponsor:</b>	Jerry B. Lingrel, Ph.D.	University of Cincinnati

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** M. S.: Hari Addagarla, Jarrod Pennington—Marshall University; Ph. D.: Catharine Clark—University of Missouri; Chris Rathbone—University of Arizona

**Postgraduate-Scholar Sponsor:** James Rush—University of Guelph; Christopher Woodman, Cris Heaps—Texas A&M; Jason Black, Nadja Spitzer—Marshall University

**Number of graduate students advised:** 5

**Number of postdoctoral scholars sponsored:** 10

## Biographical Sketch

**Betsy Ratcliff**  
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West Virginia University  
Morgantown, WV 26506

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**E-mail:** betsy.ratcliff@mail.wvu.edu

### a. Professional Preparation

Northwestern University	Chemistry	B.A. 1985
Binghamton University	Chemistry	Ph. D. 1991
University of South Dakota	Chemistry	1994-1996
		Postdoctoral Research

### b. Appointments

2008-present	Teaching Assistant Professor, Department of Chemistry, West Virginia University
2002-present	Senior Lecturer, West Virginia University
2001-2002	Temporary Assistant Professor, West Virginia University
1999-2000	Temporary Assistant Professor, West Virginia University
1996-1999	Assistant Professor, Washington and Jefferson College, Washington, PA
1993-1994	Temporary Assistant Professor, University of South Dakota, Vermillion, SD

### c. Publications

#### (i) Publications most closely related to proposal

Ratcliff, B. B., Klancke, J. W., Koppang, M. D., & Engstrom, R. C. (1996). Micro-derivatization of anodized glassy carbon. *Analytical Chemistry*, 68, 2010.

McLean, T. D., Ratcliff, B. B., Pastalan, J. Z., & Innes, K. K. (1989). Binding energies of three iodine complexes. *Journal of Quantitative Spectroscopy and Radiative Transfer*, 42, 445.

#### (ii) Other publications

none

### d. Synergistic Activities

1. Program director, Peer Led Team Learning (PLTL); obtained internal funding for pioneer and continuing semesters of a student academic resource for 3 separate general chemistry courses and for recruitment and training of 38 peer leaders; developed activity sheets for all workshop sessions
2. Originator of floor plans and contact person for construction of Chemistry Learning Center
3. Supervisor, Chemistry Learning Center
4. Member, Chemistry 110/115 Retention Committee
5. Member, West Virginia University Academic Standards Committee

### e. Collaborators and Other Affiliations

#### (i) Collaborators and Co-Editors

none

#### (ii) Graduate Advisor and Postdoctoral Sponsor

<b>Graduate Advisor:</b>	K. Keith Innes (deceased)	Binghamton University
<b>Postdoctoral Advisor:</b>	Royce Engstrom	University of South Dakota

#### (iii) Thesis Advisor and Postgraduate-Scholar Sponsor

**Thesis Advisor:** none

**Postgraduate-Scholar Sponsor:** none

**Total number of graduate students advised:** none

**Total number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Yon Rojanasakul

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P.O. Box 9530  
West Virginia University  
Morgantown, WV 26506

Phone: 304.293.1476

E-mail: yrojan@hsc.wvu.edu

### a. Professional Preparation

Mahidol University, Thailand	Pharmacy	B.S.	1982
Massachusetts College of Pharmacy and Health Sciences	Pharmaceutics	M.S.	1984
University of Wisconsin-Madison	Pharmaceutical Science	Ph.D.	1989

### b. Appointments

2009	Benedum Distinguished Professor, West Virginia University
2009	Acting Chair, Department of Basic Pharmaceutical Sciences, West Virginia University
2002	Visiting Scientist, Burnham Institute
2002-present	Faculty Member, Mary Babb Randolph Cancer Center, West Virginia University
2000-present	Professor, Department of Basic Pharmaceutical Sciences, West Virginia University
1998-present	Guest Scientist, National Institute for Occupational Safety and Health
1997	Visiting Professor, Department of Pharmacology, University of Pittsburgh
1994-2000	Associate Professor, Department of Basic Pharmaceutical Sciences, West Virginia University
1989-1994	Assistant Professor, Department of Basic Pharmaceutical Sciences, West Virginia University
1982-1984	Research Scientist, Pfeiffer Pharmaceuticals

### c. Publications

#### (i) Publications most closely related to proposal

- Rojanasakul, Y., & Robinson, J. R. (1990). Electrophysiological and ultrastructural characterization of the cornea during *in vitro* perfusion. *International Journal of Pharmaceutics*, 63, 1-16.
- Rojanasakul, Y., Wang, L., Bhat, M., Glover, D. D., Malanga, C. J., & Ma, J. K. H. (1992). Transport barrier of epithelia: A comparative study on permeability and charge selectivity. *Pharmaceutical Research*, 9, 1033-1038.
- Wang, L., Toledo, D., Malanga, C. J., Ma, J. K. H., & Rojanasakul, Y. (1993). Transport and hydrolysis of enkephalins in cultured alveolar epithelial monolayers. *Pharmaceutical Research* 10, 1662-1667.
- Chanvorachote, P., Nimmannit, U., Wang, L., Stehlik, C., Lu, B., Rojanasakul, Y., et al. (2005). Nitric oxide negatively regulates Fas (CD95)-induced apoptosis through inhibition of ubiquitin-proteasome mediated degradation of FLIP. *Journal of Biological Chemistry*, 280, 42044-42050.
- Azad, N., Vallyathan, V., Wang, L., Tantishaiyakul, V., Stehlik, C., Rojanasakul, Y., et al. (2006). S-nitrosylation of Bcl-2 inhibits its ubiquitin-proteasomal degradation: A novel anti-apoptotic mechanism that suppresses apoptosis. *Journal of Biological Chemistry*, 280, 34124-34134.

#### (ii) Other publications

- Wang, L., Ma, J. K. H., Toledo, D., Malanga, C. J., & Rojanasakul, Y. (1994). Alveolar permeability enhancement by oleic acid and related fatty acids: Evidence for a calcium-dependent mechanism. *Pharmaceutical Research*, 11, 513-517.

Rojanasakul, Y., Shi, X., Deshpande, D., Liang, W., & Wang, L. (1996). Protection against oxidative injury and permeability alterations in cultured alveolar epithelium by transferrin-catalase conjugate. *Biochimica et Biophysica Acta*, 1315, 21-28.

Yang, X., Ma, J. K. H., Malanga, C. J., & Rojanasakul, Y. (2000). Characterization of proteolytic activities of alveolar epithelium. *International Journal of Pharmaceutics*, 195, 93-101.

Chanvorachote, P., Nimmannit, U., Stehlik, C., Wang, L., Jiang, B. H., Rojanasakul, Y., et al. (2006). Nitric oxide regulates cell sensitivity to cisplatin-induced apoptosis through S-nitrosylation and inhibition of Bcl-2 ubiquitination. *Cancer Research*, 66, 6353-6360.

Xia, C., Meng, Q., Liu, L., Rojanasakul, Y., Wang, X. R., & Jiang, B. H. (2007). Reactive oxygen species regulate angiogenesis and tumor growth through vascular endothelial growth factor. *Cancer Research*, 67, 10823-10830.

#### **d. Synergistic Activities**

1. Fellow, American Association of Pharmaceutical Scientists, 2001-
2. Outstanding Researcher Award, West Virginia University, School of Pharmacy, 2007
3. Outstanding Teacher Awards, West Virginia University, School of Pharmacy, 1994, 1996, 1998, 2001, 2004, 2006, 2008
4. Member of WVNano Initiative, 2009

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

V. Castranova	NIOSH
L. Wang	NIOSH
B.H. Jiang	MBR Cancer Center, WVU
C. Stehlik	Northwestern University
X. Shi	University of Kentucky
N. Azad	Hampton University
C. Huang	New York University

##### **(ii) Graduate Advisor**

**Graduate Advisor:** J. Robinson University of Wisconsin-Madison

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Ph.D. Students: S. Talbott, D. Medan, N. Bryan, H. Elbaz, N. Azad, B. Lu, S. Dokka, K. Liang, D. Deshpande—WVU

M. S. Students: N. Swaroop, L. Luo—WVU

**Postgraduate-Scholar Sponsor:** T. Stueckle, A. Iyer, N. Azad, N. Cheng, X. Zhang, L. Wang—WVU

**Visiting Postgraduate Scholars:** L. Kongkaneramt, S. Yao, P. Chanvorachote, A. Panyosak, K. Wiwatanawongsa, J. Mounjaroen, M.S. El-Samaligy—WVU

**Total number of graduate students advised:** 11

**Total number of postdoctoral scholars sponsored:** 13

## Biographical Sketch

### Gary E. Schultz, Ph. D.

Science Building S309  
Marshall University  
1 John Marshall Drive  
Huntington, WV 25755

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E-mail: schultzga@marshall.edu

### a. Professional Preparation

Clemson University	Electrical Engineering	B.S. 1985
Florida State University	Oceanography	M. S. 1994
College of William and Mary	Marine Science	Ph.D. 1999
University of Houston	Biology and Biochemistry	1999-2000
Texas A&M University–Galveston	Marine Sciences	2000-2003
NIEHS	Laboratory of Molecular Genetics	2003-2007
		Postdoctoral Research

### b. Appointments

2008-present                      Assistant Professor, Department of Biological Sciences, College of  
Science, Marshall University

### c. Publications

#### (i) Publications most closely related to proposal

Schultz, G. E., Jr., & Ducklow, H. W. (2000). Changes in bacterioplankton metabolic capabilities along a salinity gradient in the York River estuary, Virginia, USA. *Aquatic Microbial Ecology*, 22, 163-174.

Santschi, P. H., Hung, C.-C., Schultz, G. E., Jr., Alvarado-Quiroz, N., Guo, L., Pinckney, J., et al. (2003). Control of acid polysaccharide production and <sup>234</sup>Th and POC export fluxes by marine organisms. *Geophysical Research Letters*, 30(2), No. 1044, doi 10.1029/2002GL016046.

Schultz, G. E., Jr., White, E. D., III, & Ducklow, H. W. (2003). Bacterioplankton dynamics in the York River estuary: Primary influence of temperature and freshwater inputs. *Aquatic Microbial Ecology*, 30, 135-148.

Schultz, G. E., Jr., Carver, G. T., & Drake, J. W. (2006). A role for replication repair in the genesis of templated mutations. *Journal of Molecular Biology*, 358, 963-973.

Schultz, G. E., Jr., & Drake, J. W. (2008). Templated mutagenesis in bacteriophage T4 involving imperfect direct or indirect sequence repeats. *Genetics*, 178, 671-673.

### d. Synergistic Activities

1. Published papers describing the controls on bacterial communities as well as on the biochemistry of the processes controlling the creation of complex templated mutations
2. Currently teach several critical courses in microbiology at Marshall University
3. Informally mentored several graduate students and postdoctoral fellows in the various labs of which I have been a part

### e. Collaborators and Other Affiliations

#### (i) Collaborators and Co-Editors

John W. Drake                      National Institute of Environmental Health Sciences



**(ii) Graduate Advisor and Postdoctoral Sponsors**

**Graduate Advisor:** Hugh W. Ducklow

**Postdoctoral Sponsors:** George E. Fox  
Peter H. Santschi

John W. Drake

Marine Biological Laboratory  
University of Houston  
Texas A&M University–  
Galveston  
NIEHS

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsors**

**Thesis Advisor:** none

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** none

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Xiaodong Shi

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West Virginia University  
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### a. Professional Preparation

Nankai University	Chemistry	B.S. 1994
Nankai University	Chemistry	M.S. 1997
University of Maryland-College Park	Chemistry	Ph. D. 2002
University of California-Berkeley	Chemistry	2002-2005
		Postdoctoral Research

### b. Appointments

2005-present      Assistant Professor, Bennett Department of Chemistry, West Virginia University  
2005                Platform Research Scientist, General Electric Advanced Material

### c. Publications

#### (i) Publications most closely related to proposal

Duan, H., Sengupta, S., Petersen, J. L., Akhmedov, N., & Shi, X. (2009). Triazole-au(I) complexes: A new class of catalysts with improved thermal stability and reactivity for intermolecular alkyne hydroamination. *Journal of the American Chemical Society*, 131, 12100-12102.

Zhong, C., Chen, Y., Petersen, J. L., Akhmedov, N., & Shi, X. (2009). Enantioselective intermolecular crossed-conjugate additions between nitroalkenes and  $\alpha,\beta$ -enals through a dual activation strategy. *Angewandte Chemie International Edition*, 48, 1279-1282.

Duan, H., Sengupta, S., Petersen, J. L., & Shi, X. (2009). Synthesis and characterization of NH-triazole-bound rhodium(I) complexes: Substituted-group-controlled regioselective coordination. *Organometallic*, 28, 2352-2355.

Liu, Y., Yan, W., Chen, Y., Petersen, J. L., & Shi, X. (2008). Efficient synthesis of N-2-Aryl-1,2,3-triazole fluorophores via post-triazole arylation. *Organic Letters*, 10, 5389-5392.

Sengupta, S., Duan, H., Lu, W., Petersen, J. L., & Shi, X. (2008). An organo-catalyst promoted synthesis of 4,5-disubstituted-1,2,3-(NH)-triazoles. 1493-1496.

#### (ii) Other publications

Chen, Y., Zhong, C., Sun, X., Akhmedov, N., Petersen, J. L., & Shi, X. (2009). One-pot cascade Michael-Michael-Aldol condensation for diastereoselective synthesis of nitro-substituted cyclohexanes. *Chemical Communications*, 5150-5152.

Chen, Y., Zhong, C., Petersen, J. L., Akhmedov, N., & Shi, X. (2009). One-pot asymmetric synthesis of substituted piperidines by exocyclic chirality induction. *Organic Letters*, 11, 2333-2336.

Duan, H., Sun, X., Liao, W., Petersen, J. L., & Shi, X. (2008). Proline as Lewis base catalyst: Diastereoselective synthesis of isoxazoline-N-oxide through [3 + 2] cycloaddition. *Organic Letters*, 10, 4113-4116.

Chen, Y., Liu, Y., Petersen, J. L., & Shi, X. (2008). Conformational control in the regioselective synthesis of N-2-substituted-1,2,3-triazoles. *Chemical Communications*, 3254-3256.

Zhong, C., Wang, J., Wu, N., Wu, G., & Shi, X. (2007). Anion ridged nano-sheet from self-assembled G-quadruplexes. *Chemical Communications*, 3148-3150.

**d. Synergistic Activities**

1. Outstanding Faculty Award, Department of Chemistry, West Virginia University, 2009
2. Member, American Chemical Society
3. Co-PI, NSF IRES International collaboration between WVU and Jilin University in China

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

J. Petersen	West Virginia University
Q. Wang	University of South Carolina
J. Lewis	West Virginia University
N. Wu	West Virginia University

**(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Graduate Advisor:</b>	J. Davis	University of Maryland-College Park
<b>Postdoctoral Sponsors:</b>	P. Bartlett	University of California-Berkeley
	F. D. Toste	University of California-Berkeley

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Ph.D. Students: Cheng Zhong, Sujata Sengupta, Wuming Yan, Tao Liao, Lekh Nath Gautem—West Virginia University; M. S. Students: Wenyan Liao—West Virginia University

**Postgraduate-Scholar Sponsor:** Weibing Lu, Xiaohua Sun, Haifeng Duan, Yunfeng Chen, Yuxiu Liu—West Virginia University

**Total number of graduate students advised: 6**

**Total number of postdoctoral scholars sponsored: 5**

## Biographical Sketch

### Letha J. Sooter, Ph.D.

Assistant Professor, Biology  
West Virginia University  
P.O. Box 6057  
Morgantown, WV 26506

**Phone:** 304.293.5201 x 31557

**E-mail:** letha.sooter@mail.wvu.edu

### a. Professional Preparation

Texas A&M University	Biochemistry and genetics	B.S. 1999
University of Texas-Austin	Biochemistry	Ph.D. 2004
Massachusetts Institute of Technology	Chemical Engineering	2004-2006
U.S. Army Research Laboratory	Optics	2006-2008
		Postdoctoral Research

### b. Appointments

2008-present	Assistant Professor, Department of Biology and WVNano Initiative, West Virginia University
2008 (Fall)	Adjunct Faculty, Department of Chemistry, West Virginia University
2006-2008	Postdoctoral Fellow, U.S. Army Research Laboratory, Optics Branch
2004-2006	Postdoctoral Associate, Department of Chemical Engineering, Massachusetts Institute of Technology
1999-2004	Graduate Research Assistant, Department of Chemistry and Biochemistry, University of Texas-Austin

### c. Publications

#### (i) Publications most closely related to proposal

- Sooter, L. J., Stratis-Cullum, D. N., et al. (in press). (October, 2009). Book chapter. In N. Ramanathan (Ed.), *Nanoscience and nanotechnology for chemical and biological defense*. New York: Oxford University Press: ACS Symposium Series.
- Sooter, L. J., McMasters, S., & Stratis-Cullum, D. N. (2007). Application of capillary electrophoresis to the development and evaluation of aptamer affinity probes. *Proceedings of SPIE: Smart Biomedical and Physiological Sensor Technology V*, No. 6759-31.
- Sooter, L. J., Stratis-Cullum, D. N., Zhang, Y., Daugherty, P., Soh, H. T., Pellegrino, P. M., et al. (2007). Affinity reagent technology development and application to rapid immunochromatographic pathogen detection. *Proceedings of SPIE: Smart Biomedical and Physiological Sensor Technology V*, No. 6759-10.
- Sooter, L. J., Gates-Shannon, P., & Ellington, A. D. (2007). Automated assessment of the DNA-binding capacity of a proteome by *in vitro* selection. *Journal of the Association for Laboratory Automation*, 12(3), 135-142.
- Sooter, L. J., & Ellington, A. D. (2004). Automated selection of transcription factor binding sites. *Journal of the Association for Laboratory Automation*, 9(5), 277-284.

#### d. Synergistic Activities

1. Created a senior undergraduate/graduate level course with the topic of molecular recognition elements and sensors
2. Member, American Chemical Society, American Institute of Chemical Engineers, Association for Laboratory Automation, Society for Women Engineers, American Association of University Women

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

Daugherty, Patrick	University of California
McMasters, Sun	Dugway Proving Ground
Pellegrino, Paul M.	United States Army Research Laboratory
Soh, H. Tom	University of California, Santa Barbara
Stagliano, Nancy	Cynvenio Biosystems
Stratis-Cullum, Dimitra N.	United States Army Research Laboratory
Zhang, Yanting	Cynvenio Biosystems

**(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Graduate Advisor:</b>	Andrew D. Ellington	University of Texas-Austin
<b>Postdoctoral Sponsor:</b>	K. Dane Wittrup	Massachusetts Institute of Technology

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

<b>Doctoral Thesis Advisor:</b>	Anthony S. Giovengo	West Virginia University
<b>Master's Thesis Advisor:</b>	Smita Singh	West Virginia University
<b>Postgraduate-Scholar Sponsor:</b>	Bridget Hines	West Virginia University

**Number of graduate students advised: 2**

**Number of postdoctoral scholars sponsored: 1**

## Biographical Sketch

**Aaron Timperman, Ph. D.**  
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**E-mail:** atimperm@mail.wvu.edu

### a. Professional Preparation

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

### b. Appointments

2005-present	Associate Professor, Department of Chemistry, West Virginia University
1999-2005	Assistant Professor, Department of Chemistry, West Virginia University

### c. Publications

#### (i) Publications most closely related to proposal

Edwards, B. F., Timperman, A. T., Carroll, R. L., Jo, K. D., Mease, J. M., & Schiffbauer, J. E. (2009). Traveling-wave electrophoresis for microfluidic separations. *Physical Review Letters*, *102*, 076103(1-4).

Reschke, B. R., Luo, H., Schiffbauer J., Edwards, B. F., & Timperman, A. T. (2009). A theoretical and experimental study of the electrophoretic extraction of ions from a pressure driven flow in a microfluidic device. *Lab on a Chip*, *9*, 2203-2211.

Kelly, K. C., Miller, S. A., & Timperman, A. T. (2009). Investigation of zone migration in a current rectifying nanofluidic/microfluidic analyte concentrator. *Analytical Chemistry*, *81*, 732-738.

Razunguzwa, T. T., Lenke, J., & Timperman, A. T. (2005). A stable electrokinetic/hydrodynamic flow microfluidic CE-ESI/MS interface utilizing a hydrodynamic flow restrictor for delivery of samples under low EOF conditions. *Lab on a Chip*, *5*, 851-855.

Zhang, Y., & Timperman, A. T. (2003). Integration of nanocapillary arrays into microfluidic devices for use as analyte concentrators. *Analyst*, *128*, 537-542.

#### (ii) Other publications

Razunguzwa, T. T., Warriar, M., & Timperman, A. T. (2006). An ESI-MS compatible permanent coating of glass surfaces using polyethylene glycol terminated alkoxysilanes for capillary zone electrophoretic protein separations. *Analytical Chemistry*, *78*, 4326-4333.

Miller, S. A., Kelly, K. C., & Timperman, A. T. (2008). Ionic current rectification at a nanofluidic/microfluidic interface with an asymmetric microfluidic system. *Lab on a Chip*, *8*, 1729-1732.

Powell, M. J., Sutton, J. N., Del Castillo, C. E., & Timperman, A. T. (2005). Marine proteomics: Generation of sequence tags for dissolved proteins in seawater using tandem mass spectrometry. *Marine Chemistry*, *95*, 183-198.

Razunguzwa, T., & Timperman, A. T. (2004). Fabrication and characterization of a fritless microfabricated electroosmotic pump with reduced pH dependence. *Analytical Chemistry*, *76*, 1336-1341.

Morris, D. L., Sutton, J. N., Harper, R. G., & Timperman, A. T. (2004). Reversed phase HPLC separation of human serum employing a novel saw tooth gradient: Toward multidimensional proteome analysis. *Journal of Proteome Research*, 3, 1149-1154.

#### **d. Synergistic Activities**

1. Member of the WVNano Initiative at WVU, the objectives of which are to solidify and grow NSEE research, advance supporting NSEE research infrastructure, and build an interdisciplinary and collaborative culture
2. Developed an interdisciplinary graduate course in Proteomics, taken by students from chemistry, biology, microbiology, basic pharmaceutical sciences, and plant and soil sciences at WVU; helped establish and design Core Proteomics Facility at WVU Health Sciences Center
3. Actively recruited minorities and women to work in my group—currently, I have three graduate students, including two females, and one male. I have had three undergraduate students work in my lab in the last two years, and one high school student for the last two summers.
4. Organized eight invited mass spectrometry sessions for the FACSS (Federation of Analytical Chemistry & Spectroscopy Societies) 29<sup>th</sup> Annual meeting in Providence, RI, October, 2002; included was a session on MS in marine systems: “Environmental Mass Spectrometry Studies in Marine Systems.” Co-chaired and presided at an American Electrophoresis Society Symposium (“Advances in Proteomic Analysis: Biomedical Applications”), part of the American Institute of Chemical Engineers Meeting in Cincinnati, OH, November, 2005. Organized and presided at a session, “Analysis of Dissolved Organic Matter Using Mass Spectrometry,” at FACSS 2006, in Orlando, FL
5. Served as a science advisor for Protea Biosciences of Morgantown, WV, and submitted six patent applications submitted the WVU Research Corporation

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

R. L. Carroll	West Virginia University	E. Gawalt	Duquesne University
C. Del Castillo	Johns Hopkins University	L. Hornak	West Virginia University
J. Cumming	West Virginia University	D. Lederman	West Virginia University
J. Dawson	West Virginia University	L. Salati	West Virginia University
B. Edwards	West Virginia University	X. Shi	West Virginia University

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Graduate Advisor:</b>	Jonathan Sweedler	University of Illinois,
<b>Postdoctoral Sponsors:</b>	Paula Coble	University of South Florida
	Ruedi Aebersold	Institute for Systems Biology

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** M. S.: Erica Jackson, Carson Baldwin, Guimei Cai—WVU; Ph. D.: Matthew Powell, Trust Razunguzwa, Kathleen Kelly, Brent Reshke, Han Wang—WVU

**Postgraduate-Scholar Sponsor:** Ying Zhang, Manoj V. Warriar, Scott Miller, Min Soo Lim, Yuchen Lu, Kyoo Dong Jo—WVU; Xiuli Mao, Virginia Tech

**Total number of graduate students advised: 13**

**Total number of postdoctoral scholars sponsored: 7**

## Biographical Sketch

### Eva Erdosne Toth, Ph. D.

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Morgantown, WV 26506

**Phone:** 304.293.7239

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### a. Professional Preparation

Eotvos Lorand University, Budapest Hungary	Natural Sciences	M.S. 1981
Eotvos Lorand University, Budapest Hungary	Biology and Chemistry	Teaching Certificate, Grades 7-12 (1981)
University of Illinois, Urbana- Champaign	Curriculum & Instruction (Focus: Inst. Technology)	M. Ed. 1990
University of Illinois, Urbana- Champaign	Curriculum & Instruction	Ph. D. 1996

### b. Appointments

July 2009-present	Assistant Professor, Science Education, H R & E; Educational Researcher, WVNano Initiative, West Virginia University
2006-2009	Assistant Professor, Department of Educational Foundations and Leadership, School of Education, Duquesne University
2001-2006	Vice Director for Education, Center for Genomic Sciences, Allegheny Singer Research Institute, Allegheny General Hospital, Pittsburgh, PA
1997-2001	Senior Research Associate, Department of Psychology, Carnegie Mellon University
2000-2001	Senior Fellow, Eberly Center for Teaching Excellence, Carnegie Mellon University
1995-1998	Postdoctoral Research Associate, LRDC, University of Pittsburgh (dual appointment with Carnegie Mellon University for 6 months)
1993-1995	EarthVision Coordinator and Teaching Fellow, Saginaw Valley State University, Saginaw, MI

### c. Publications

#### (i) Publications most closely related to proposal

Toth, E. E. (in press). "Virtual Inquiry" in the science classroom: What is the role of technological pedagogical content knowledge? *International Journal of Communication Technology in Education*.

Toth, E. E., Morrow, B. L., & Ludvico, L. R. (2008). Designing blended inquiry learning in a laboratory context: A study of incorporating hands-on and virtual laboratories. *Innovation in Higher Education*, 33(5), 333-344.

Toth, E. E., Suthers, D. D., & Lesgold, A. (2002). Mapping to know: The effects of representational guidance and reflective assessment on scientific inquiry skills. *Science Education*, 86 (2), 264-286.

Toth, E. E., Klahr, D., & Chen, Z. (2000). Bridging research and practice: A cognitively-based classroom intervention for teaching experimentation skills to elementary school children. *Cognition and Instruction*, 18(4), 423-459.

McCown, R., Moss, C., Schreiber, J., Peterson, S., & Toth, E. E. (2009). *Instructor's Resource Manual for Psychology Applied to Teaching* (12<sup>th</sup> ed.). Boston: Houghton-Mifflin.



**(ii) Other publications**

Klahr, D., Chen, Z., & Toth, E. E. (2001). From cognition to instruction to cognition: A case study in elementary school science instruction. In K. Crowley, C. D. Schunn, & T. Okada (Eds.), *Designing for Science: Implications from Professional, Instructional, and Everyday Science*. Mahwah, NJ: Erlbaum.

**d. Synergistic Activities**

1. Member, American Educational Research Association, National Association for Research on Science Teaching, National Science Teachers' Association
2. Proposal reviewer, National Science Foundation (DR-K12: Discovery Research and ITEST: Information Technology Experiences for Students and Teachers programs)
3. Journal manuscript reviewer, *Journal of Research on Science Teaching*, *Journal of Educational Computing Research*
4. PI, Pedagogical Supports for Scientific Inquiry during Hands-On and Virtual Laboratory Investigations, Duquesne University faculty development grant (\$9,944), 2007-2009
5. PI (through October 2006), co-PI, Mentoring Teachers through Pedagogical Content Knowledge Development, Teacher Quality Program of IES, U.S. Department of Education (\$957,800), 2005-2009

**e. Collaborators and Other Affiliations**

**(i) Collaborators and Co-Editors**

S. Ambrose	Carnegie Mellon University
S. Brem	Arizona State University
G. Ehrlich	Allegheny Singer Research Institute, Pittsburgh, PA
G. Erdos	University of Pittsburgh
D. Klahr	Carnegie Mellon University
L. Ludovico	Duquesne University
R. M. McCown	Duquesne University
B. Morrow	Duquesne University
C. Post	Allegheny Singer Research Institute, Pittsburgh, PA

**(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisors:** James A. Levin and Michael Waugh—University of Illinois, Champaign-Urbana (UIUC)

**Postdoctoral Sponsors:** Presidential Technology Initiative, Department of Defense Dependent Schools (DODDS)

**(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** none

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** none

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Wendy C. Trzyna, Ph. D.

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Huntington, WV 25755

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E-mail: trzyna@marshall.edu

### a. Professional Preparation

Illinois State University  
University of Wyoming  
University of Wyoming  
Thomas Jefferson University

Biological Sciences  
Molecular Biology

B. S. 1985  
Ph. D. 1993  
1994-1995  
1995-1998  
Postdoctoral Fellow

### b. Appointments

2007-present	Assistant Professor, Department of Biology, Marshall University
2003-2007	Assistant Professor, Louisiana Tech University
2002-2003	Visiting Assistant Professor, University of Central Arkansas
1999-2002	Research Scientist, University of Wyoming
1998-1999	Research Technician, University of Chicago

### c. Publications

#### (i) Publications most closely related to proposal

Cordingley, J. S., & Trzyna, W. C. (2008). Multiple factors affecting growth and encystment of *Acanthamoeba castellanii* in axenic culture. *Acta Protocol*, 47, 307-316.

Trzyna, W. C., Legras, X. D., & Cordingley, J. S. (2008). A type 1 metacaspase from *Acanthamoeba castellanii*. *Microbiological Research*, 163(4), 414-23.

Gabbeta, V., Trzyna, W., Phiel, C., & McHugh, K. M. (2003, September). Vesicle-associated Protein-A is differentially expressed during intestinal smooth muscle cell differentiation. *Developmental Dynamics*, 228(1), 11-20.

Chandel, N. S., Trzyna, W. C., McClintock, D. S., & Schumacker, P. T. (2000, July). Role of oxidants in NF-kappaB activation and TNF-alpha gene transcription induced by hypoxia and endotoxin. *Journal of Immunology*, 165(2), 1013-1021.

Trzyna, W., Gabbeta, V., & McHugh, K. M. (1997, September-October). Isolation and characterization of a novel short chain alcohol dehydrogenase-like isozyme by differential display of distinct smooth muscle cell phenotypes. *Journal of Steroid Biochemistry and Molecular Biology*, 63(1-3), 115-121.

#### (ii) Other publications

Weston, W. M., LeClair, E. E., Trzyna, W., McHugh, K. M., Nugent, P., Lafferty, C. M., et al. (1999, May 7). Differential display identification of *plunc*, a novel gene expressed in embryonic palate, nasal epithelium, and adult lung. *Journal of Biological Chemistry*, 274(19), 13698-13703.

Brittingham, J., Phiel, C., Trzyna, W. C., Gabbeta, V., & McHugh, K. M. (1998, September). Identification of distinct molecular phenotypes in cultured gastrointestinal smooth muscle cells. *Gastroenterology*, 115(3), 605-617.

Trzyna, W., McHugh, M., McCue, P., & McHugh, K. M. (1997, July 15). Molecular determination of the malignant potential of smooth muscle neoplasms. *Cancer*, 80, 211-217.

Hernandez, H. J., Trzyna, W. C., Cordingley, J. S., Brodeur, P. H., & Stadecker, M. J. (1997, March). Differential antigen recognition by T cell populations from strains of mice developing polar forms of granulomatous inflammation in response to eggs of *Schistosoma mansoni*. *European Journal of Immunology*, 27, 666-670.

Trzyna, W. C., & Cordingley, J. S. (1993, November). *Schistosoma mansoni*: Genetic non-response to p40, the major protein antigen of the egg, reveals a novel mechanism enhancing IgM production. *Parasite Immunology*, 15, 601-611.

#### **d. Synergistic Activities**

1. Mentor, graduate and undergraduate research students at Marshall University, several of whom have presented at local research days; presenter, 4 national meetings and 1 international; attendee at 9 university, 2 regional, and 1 international conference over the last 5 years
2. Mentor, 26 undergraduate students (10 women) and 12 graduate students (5 women, 4 minorities)
3. Funding history: "Equipment for a Biotechnology/Molecular Biology Learning Laboratory" (with Dr. M. Swanson), Louisiana Tech University Student Technology Fee Board grant (\$34,400), Fall 2005; purchase of "Sequencher" software and site licenses for Biology Department computer lab (with Drs. Colgan, Swanson, and Voziyanov), Student Technology Fee Board (\$40,000), Fall 2004
4. Courses taught: microbiology and molecular biology, Louisiana Tech University (average of 5 courses/year, 4 courses/summer), 2003-2007; microbiology, Marshall University (2 courses/year), 2007-2008
5. Department and University committees: Undergraduate Curriculum committee, 2007-present; Graduate Curriculum committee, 2007-present; Marshall University Graduate Council, 2008-Present

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators**

W. Colgan	ADInstruments, Colorado Springs, CO	M. Swanson	Univ. of Nebraska
A. J. Leffler	University of Utah	M. Vavarek	Glenville St. Coll., WV
A. Rogerson	California State Univ.-Fresno	Y. Voziyanov	Louisiana Tech Univ., Ruston, LA

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisor:** Randolph V. Lewis                      University of Wyoming

**Postdoctoral Sponsors:** K. M. McHugh—The Ohio State University; C. Villemez (retired)—University of Wyoming

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** M. Mbugua, D. Desser, S. Howard, E. Lacey, M. Bennett—Marshall University; X. Legras, C. Blomberg, H. Patel, R. Lacey—Louisiana Tech University

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 9

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Bin Wang, Ph. D.

BBSC 241L  
College of Science  
Marshall University  
1 John Marshall Drive  
Huntington, WV 25755

Phone: 304.696.3456

E-mail: wangb@marshall.edu

### a. Professional Preparation

Beijing Medical University, China	Pharmaceutical Chemistry	B.S. 1994
National University of Singapore	Pharmacy	M.S. 2003
Queen's University at Kingston, Canada	Analytical Chemistry	Ph. D. 2004
Queen's University at Kingston, Canada	Biochemistry	2004-2005
University of North Carolina-Chapel Hill	Biochemistry	2005-2007
		Postdoctoral Research

### b. Appointments

2007-present	Assistant Professor of Chemistry, College of Science, Marshall University
1994-1999	Assistant Engineer of Chemistry, Beijing Research Institute of Pharmaceutical Industry, China

### c. Publications

#### (ii) Publications most closely related to proposal

Wang, B., Wilkinson, K. A., & Weeks, K. M. (2008). Complex ligand-induced conformational changes in tRNA<sup>Asp</sup> revealed by single nucleotide resolution SHAPE chemistry. *Biochemistry*, *47*, 3454-3461.

Wang, B., Oleschuk, R. D., Petkovich, P. M., & Horton, J.H. (2007). Chemical force titrations of antigen- and antibody-modified poly(methylmethacrylate). *Colloids and Surfaces B: Biointerfaces*, *55*, 107-114.

Wang, B., Horton, J. H., & Oleschuk, R.D. (2006). Sulfonated-polydimethylsiloxane (PDMS) microdevices with enhanced electroosmotic pumping and stability. *Canadian Journal of Chemistry*, *84*, 720-729.

Wang, B., Oleschuk, R. D., & Horton, J. H. (2005). Chemical force titrations of amine- and sulfonic acid-modified polydimethylsiloxane (PDMS). *Langmuir*, *21*, 1290-1298.

Wang, B., Horton, J. H., & Oleschuk, R. D. (2004). Sulfonic acid derivatized PDMS microfluidic devices exhibiting enhanced stability and electrokinetic pumping. *Micro Total Analysis Systems [Special Publication – Royal Society of Chemistry 297]*, *2*, 109-111.

#### (ii) Other publications

Wang, B., Chen, L., Abdulali-Kanji, Z., Horton, J. H., & Oleschuk, R. D. (2003). Aging effects on oxidized and amine-modified poly(dimethylsiloxane) surfaces studied with chemical force titrations: Effects on electroosmotic flow rate in microfluidic channels. *Langmuir*, *19*, 9792-9798.

Wang, B., Abdulali-Kanji, Z., Dodwell, E., Horton, J. H., & Oleschuk, R. D. (2003). Surface characterization using chemical force microscopy and the flow performance of modified polydimethylsiloxane for microfluidic device applications. *Electrophoresis*, *24*, 1442-1450.

Wang, B., Nita, S., Horton, J. H., & Oleschuk, R. D. (2002). Surface modification of PDMS for control of electroosmotic flow: Characterization using atomic and chemical force microscopy. *Proceedings of the  $\mu$ TAS Symposium, Micro Total Analysis Systems, 1*, 431-433.

#### **d. Synergistic Activities**

1. Awarded teaching scholarship to develop experiment for an integrated lab course
2. Developing a lab manual for analytical chemistry course at Marshall University
3. Mentored 11 undergraduates in the past two years

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

Eric Blough	Marshall University
Xiaojuan Fan	Marshall University
Michael Norton	Marshall University

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

<b>Graduate Advisor:</b>	Richard D. Oleschuk	Queen's University at Kingston, Ontario, Canada
<b>Postdoctoral Sponsors:</b>	P. Martin Petkovich	Queen's University at Kingston, Ontario, Canada
	Kevin M. Weeks	University of North Carolina-Chapel Hill

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** none

**Postgraduate-Scholar Sponsor:** none

**Number of graduate students advised:** 2—Marshall University

**Number of postdoctoral scholars sponsored:** none

## Biographical Sketch

### Nianqiang Wu, Ph. D.

515 Engineering and Sciences Building  
P.O. Box 6106  
West Virginia University  
Morgantown, WV 26506

Phone: 304.293.3326

E-mail: nick.wu@mail.wvu.edu

### a. Professional Preparation

Zhejiang University, China	Materials Science	B. S. 1990
Zhejiang University, China	Materials Science	M. S. 1993
Zhejiang University, China	Materials Science	Ph. D. 1997
University of Pittsburgh	Materials Science	1999-2001
		Postdoctoral Research

### b. Appointments

2005-present	Assistant Professor, Department of Mechanical and Aerospace Engineering, West Virginia University
2001-2005	Research Scientist and Manager, Keck Interdisciplinary Surface Science Center, Northwestern University
1999-2001	Research Associate, University of Pittsburgh
1998-1999	Research Associate, University of Calgary, Canada

### c. Publications

#### (i) Publications most closely related to proposal

- Li, H., & Wu, N. Q. (2008). A large-area nanoscale gold hemisphere pattern as a nanoelectrode array. *Nanotechnology*, 19(27), 275301.
- Yang, M., Wang, J., Li, H., Zheng, J.-G., & Wu, N. Q. (2008). A lactate electrochemical biosensor with a titanate nanotube as direct electron transfer promoter. *Nanotechnology*, 19(7), 075502.
- Li, H., Low, J., Brown, K. S., & Wu, N. Q. (2008). Large-area well-ordered nanodot array pattern fabricated with self-assembled nanosphere template. *IEEE Sensors Journal*, 8(6), 880-884.
- Pan, Z., Donthu, S., Wu, N. Q., Li, S., & Dravid, V. P. (2006). Directed fabrication of radially stacked multifunctional oxide heterostructures using soft electron beam lithography (soft-eBL). *Small*, 2(2), 274-280.
- Donthu, S., Pan, Z., Myers, B., Shekhawat, G., Wu, N. Q., & Dravid, V. P. (2005). A facile scheme for fabricating solid state nanostructures using e-beam lithography and solution precursors. *Nano Letters*, 5, 1710-1715.

#### (ii) Other publications

- Wang, J., Tafen, D. N., Lewis, J. P., Hong, Z., Manivannan, A., Wu, N.Q., et al. Origin of the photocatalytic activity of nitrogen-doped TiO<sub>2</sub> nanobelts. *Journal of the American Chemical Society*, 131, 12290–12297.
- Tafen, D., Wang, J., Wu, N. Q., & Lewis, J. P. (2009). Visible light photocatalytic activity in nitrogen-doped TiO<sub>2</sub> nanobelts. *Applied Physics Letters*, 94, 093101.
- Jiang, C., Wang, F., Wu, N. Q., & Liu, X. G. (2008). Up- and down-conversion cubic zirconia and hafnia nanobelts. *Advanced Materials*, 20, 4826-4829.

Zhi, M., Chen, X., Finklea, H., Celik, I., & Wu, N. Q. (2008). Electrochemical and microstructural analysis of Ni-yttria stabilized zirconia electrode operated in phosphorus-containing syngas. *Journal of Power Sources*, 183, 485–490.

Wu, N. Q., Zhao, M., Zheng, J.-G., Jiang, C., Myers, B., Chyu, M., et al. (2005). Porous CuO-ZnO nanocomposite for sensing electrode of high-temperature CO solid-state electrochemical sensor. *Nanotechnology*, 16, 2878–2881.

#### **d. Synergistic Activities**

1. Journal reviewer, *Nanotechnology*, *Journal of Nanoscience and Nanotechnology*, *IEEE Transactions on Nanotechnology*, *Journal of Nano Education*, *Journal of the American Chemical Society*, *Journal of Physical Chemistry B*, *Electrochemistry Communications*, *Electrochimica Acta*, *Advanced Materials*, *Journal of Crystal Growth*, *Carbon*, *Materials Science & Engineering A*, *Materials Letters*, *Journal of Nanoparticle Research*, *Semiconductor Science & Technology*, *Applied Physics Letters*, *Journal of Physics C: Condensed Matter*, *Journal of Physics D: Applied Physics*, *Advanced Science Letters*, and *Biomacromolecules*
2. Panelist and proposal reviewer, National Science Foundation (NSF), Department of Energy (DoE), ACS Petroleum Research Fund, WVU Faculty Senate Grant, North Carolina Biotechnology Center, ad hoc NIH-Bioengineering Sciences and Technology group (2009), Natural Sciences and Engineering Research Council (NSERC), Canada (2007-2012); evaluator, MacArthur Fellows program
3. Member, Materials Research Society, American Chemical Society, Electrochemical Society, WVNano initiative
4. Member, WVU Materials Science and Engineering (MSE) program committee, which developed the MSE curriculum toward establishing MSE M. S. and Ph. D. degrees and generated new MSE courses
5. Associate editor, *Journal of Energy Storage and Conversion*, 2008-

#### **e. Collaborators and Other Affiliations**

##### **(i) Collaborators and Co-Editors**

J. Appleby	Texas A&M University	V. Castranova	NIOSH
V. Dravid	Northwestern University	U. H. Hömmerich	Hampton University
A. Holian	University of Montana	H. Kung	Northwestern University
S. X. Mao	University of Pittsburgh	R. Ruoff	Northwestern University
D. Porter	NIOSH	K. Sriram	NIOSH
M. Su	University of Central Florida	C. Wang	University of Maryland

##### **(ii) Graduate Advisors and Postdoctoral Sponsors**

**Graduate Advisor:** ZhiZhang Li—Zhejiang University, China

**Postdoctoral Sponsor:** Scott Mao—University of Pittsburgh

##### **(iii) Thesis Advisor and Postgraduate-Scholar Sponsor**

**Thesis Advisor:** Mingjia Zhi, Ming Li, Yueting Wu, Fanke Meng, Chengcheng Xiang, Yuan Liu—WVU

**Postgraduate-Scholar Sponsor:** Huaqing Li—University of Tennessee

**Visiting Scholar Sponsor:** Mingli Yang—WVU

**Number of graduate students advised:** 6

**Number of postdoctoral scholars sponsored:** 2

# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION <b>Higher Education Policy Commission</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Paul L Hill</b>				AWARD NO.			
				Proposed	Granted		
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		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Paul L Hill - Program Director</b>				6.00	0.00	0.00	\$ <b>67,855</b>
2. <b>Jan Taylor - Deputy Program Director</b>				3.00	0.00	0.00	<b>22,295</b>
3.							
4.							
5.							
6. ( <b>0</b> ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	<b>0</b>
7. ( <b>2</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				9.00	0.00	0.00	<b>90,150</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>1</b> ) POST DOCTORAL SCHOLARS				12.00	0.00	0.00	<b>44,500</b>
2. ( <b>0</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	<b>0</b>
3. ( <b>0</b> ) GRADUATE STUDENTS							<b>0</b>
4. ( <b>0</b> ) UNDERGRADUATE STUDENTS							<b>0</b>
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							<b>0</b>
6. ( <b>0</b> ) OTHER							<b>0</b>
TOTAL SALARIES AND WAGES (A + B)							<b>134,650</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>27,010</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>161,660</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							<b>0</b>
E. TRAVEL							<b>26,000</b>
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							<b>26,000</b>
2. FOREIGN							<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ _____				<b>0</b>			
2. TRAVEL _____				<b>0</b>			
3. SUBSISTENCE _____				<b>0</b>			
4. OTHER _____				<b>0</b>			
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> )							
TOTAL PARTICIPANT COSTS							<b>0</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>0</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							<b>9,200</b>
3. CONSULTANT SERVICES							<b>70,000</b>
4. COMPUTER SERVICES							<b>0</b>
5. SUBAWARDS							<b>3,650,000</b>
6. OTHER							<b>29,750</b>
TOTAL OTHER DIRECT COSTS							<b>3,758,950</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>3,946,610</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>Total Direct less G5 Subawards (Rate: 18.0000, Base: 296610)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>53,390</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>4,000,000</b>
K. RESIDUAL FUNDS							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ <b>4,000,000</b> \$
M. COST SHARING PROPOSED LEVEL \$ <b>800,000</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Paul L Hill</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	



# SUMMARY PROPOSAL BUDGET

YEAR 2

ORGANIZATION <b>Higher Education Policy Commission</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Paul L Hill</b>				AWARD NO.	Proposed	Granted	
				A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)			
				CAL	ACAD	SUMR	
1.	<b>Paul L Hill - Program Director</b>			6.00	0.00	0.00	\$ <b>69,891</b>
2.	<b>Jan Taylor - Deputy Program Director</b>			3.00	0.00	0.00	<b>22,965</b>
3.							
4.							
5.							
6.	( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	<b>0</b>
7.	( 2 ) TOTAL SENIOR PERSONNEL (1 - 6)			9.00	0.00	0.00	<b>92,856</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 1 ) POST DOCTORAL SCHOLARS			12.00	0.00	0.00	<b>45,835</b>
2.	( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	<b>0</b>
3.	( 0 ) GRADUATE STUDENTS						<b>0</b>
4.	( 0 ) UNDERGRADUATE STUDENTS						<b>0</b>
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						<b>0</b>
6.	( 0 ) OTHER						<b>0</b>
TOTAL SALARIES AND WAGES (A + B)							<b>138,691</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>27,820</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>166,511</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							<b>0</b>
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							<b>26,520</b>
2. FOREIGN							<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	<u>                    </u>				<b>0</b>
2.	TRAVEL		<u>                    </u>				<b>0</b>
3.	SUBSISTENCE		<u>                    </u>				<b>0</b>
4.	OTHER		<u>                    </u>				<b>0</b>
TOTAL NUMBER OF PARTICIPANTS ( 0 )				TOTAL PARTICIPANT COSTS			<b>0</b>
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						<b>925</b>
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						<b>9,384</b>
3.	CONSULTANT SERVICES						<b>71,400</b>
4.	COMPUTER SERVICES						<b>0</b>
5.	SUBAWARDS						<b>3,640,000</b>
6.	OTHER						<b>30,345</b>
TOTAL OTHER DIRECT COSTS							<b>3,752,054</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>3,945,085</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Total Direct less G5 Subawards (Rate: 18.0000, Base: 305085)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>54,915</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>4,000,000</b>
K. RESIDUAL FUNDS							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ <b>4,000,000</b> \$
M. COST SHARING PROPOSED LEVEL \$ <b>800,000</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Paul L Hill</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

# SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION <b>Higher Education Policy Commission</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Paul L Hill</b>				AWARD NO.	Proposed	Granted	
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		Funds Requested By proposer	Funds granted by NSF (if different)
		CAL	ACAD	SUMR			
1.	<b>Paul L Hill - Program Director</b>	6.00	0.00	0.00	\$ 71,987	\$	
2.	<b>Jan Taylor - Deputy Program Director</b>	3.00	0.00	0.00	23,654		
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)	9.00	0.00	0.00	95,641		
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 1 ) POST DOCTORAL SCHOLARS	12.00	0.00	0.00	47,210		
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)					142,851		
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)					28,655		
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)					171,506		
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)					26,520		
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				167		
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				9,384		
3.	CONSULTANT SERVICES				71,400		
4.	COMPUTER SERVICES				0		
5.	SUBAWARDS				3,635,000		
6.	OTHER				30,345		
TOTAL OTHER DIRECT COSTS					3,746,296		
H. TOTAL DIRECT COSTS (A THROUGH G)					3,944,322		
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Total Direct less G5 Subawards (Rate: 18.0000, Base: 309322)</b>							
TOTAL INDIRECT COSTS (F&A)					55,678		
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)					4,000,000		
K. RESIDUAL FUNDS					0		
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)					\$ 4,000,000	\$	
M. COST SHARING PROPOSED LEVEL \$ <b>800,000</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Paul L Hill</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

# SUMMARY PROPOSAL BUDGET

YEAR 4

ORGANIZATION <b>Higher Education Policy Commission</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Paul L Hill</b>				AWARD NO.			
				Proposed	Granted		
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		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Paul L Hill - Program Director</b>				6.00	0.00	0.00	\$ <b>71,987</b>
2. <b>Jan Taylor - Deputy Program Director</b>				3.00	0.00	0.00	<b>23,654</b>
3.							
4.							
5.							
6. ( <b>0</b> ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	<b>0</b>
7. ( <b>2</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				9.00	0.00	0.00	<b>95,641</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>1</b> ) POST DOCTORAL SCHOLARS				12.00	0.00	0.00	<b>47,210</b>
2. ( <b>0</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	<b>0</b>
3. ( <b>0</b> ) GRADUATE STUDENTS							<b>0</b>
4. ( <b>0</b> ) UNDERGRADUATE STUDENTS							<b>0</b>
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							<b>0</b>
6. ( <b>0</b> ) OTHER							<b>0</b>
TOTAL SALARIES AND WAGES (A + B)							<b>142,851</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>28,655</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>171,506</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							<b>0</b>
E. TRAVEL							<b>26,520</b>
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							<b>26,520</b>
2. FOREIGN							<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ _____				<b>0</b>			
2. TRAVEL _____				<b>0</b>			
3. SUBSISTENCE _____				<b>0</b>			
4. OTHER _____				<b>0</b>			
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> )							
TOTAL PARTICIPANT COSTS							<b>0</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>167</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							<b>9,384</b>
3. CONSULTANT SERVICES							<b>71,400</b>
4. COMPUTER SERVICES							<b>0</b>
5. SUBAWARDS							<b>3,635,000</b>
6. OTHER							<b>30,345</b>
TOTAL OTHER DIRECT COSTS							<b>3,746,296</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>3,944,322</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>Total Direct less G5 Subawards (Rate: 18.0000, Base: 309322)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>55,678</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>4,000,000</b>
K. RESIDUAL FUNDS							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ <b>4,000,000</b> \$
M. COST SHARING PROPOSED LEVEL \$ <b>800,000</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Paul L Hill</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked		Date Of Rate Sheet		Initials - ORG	

# SUMMARY PROPOSAL BUDGET

YEAR 5

ORGANIZATION <b>Higher Education Policy Commission</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Paul L Hill</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
		CAL	ACAD	SUMR			
1.	<b>Paul L Hill - Program Director</b>	6.00	0.00	0.00	\$ 71,987	\$	
2.	<b>Jan Taylor - Deputy Program Director</b>	3.00	0.00	0.00	23,654		
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)	9.00	0.00	0.00	95,641		
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 1 ) POST DOCTORAL SCHOLARS	12.00	0.00	0.00	47,210		
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)					142,851		
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)					28,655		
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)					171,506		
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)					26,520		
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					9,384		
3. CONSULTANT SERVICES					71,400		
4. COMPUTER SERVICES					0		
5. SUBAWARDS					3,637,846		
6. OTHER					28,100		
TOTAL OTHER DIRECT COSTS					3,746,730		
H. TOTAL DIRECT COSTS (A THROUGH G)					3,944,756		
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Total Direct less G5 Subawards (Rate: 18.0000, Base: 306910)</b>							
TOTAL INDIRECT COSTS (F&A)					55,244		
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)					4,000,000		
K. RESIDUAL FUNDS					0		
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)					\$ 4,000,000	\$	
M. COST SHARING PROPOSED LEVEL \$ <b>800,000</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Paul L Hill</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

# SUMMARY PROPOSAL BUDGET

Cumulative

ORGANIZATION <b>Higher Education Policy Commission</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Paul L Hill</b>				AWARD NO.	Proposed	Granted	
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		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Paul L Hill - Program Director</b>			30.00	0.00	0.00	\$ <b>353,707</b>
2.	<b>Jan Taylor - Deputy Program Director</b>			15.00	0.00	0.00	<b>116,222</b>
3.							
4.							
5.							
6.	( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	<b>0</b>
7.	( <b>2</b> ) TOTAL SENIOR PERSONNEL (1 - 6)			45.00	0.00	0.00	<b>469,929</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( <b>5</b> ) POST DOCTORAL SCHOLARS			60.00	0.00	0.00	<b>231,965</b>
2.	( <b>0</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	<b>0</b>
3.	( <b>0</b> ) GRADUATE STUDENTS						<b>0</b>
4.	( <b>0</b> ) UNDERGRADUATE STUDENTS						<b>0</b>
5.	( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						<b>0</b>
6.	( <b>0</b> ) OTHER						<b>0</b>
TOTAL SALARIES AND WAGES (A + B)							<b>701,894</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>140,795</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>842,689</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							<b>0</b>
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							<b>132,080</b>
2. FOREIGN							<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	<b>0</b>				
2.	TRAVEL		<b>0</b>				
3.	SUBSISTENCE		<b>0</b>				
4.	OTHER		<b>0</b>				
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> )				TOTAL PARTICIPANT COSTS			<b>0</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>1,259</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							<b>46,736</b>
3. CONSULTANT SERVICES							<b>355,600</b>
4. COMPUTER SERVICES							<b>0</b>
5. SUBAWARDS							<b>18,197,846</b>
6. OTHER							<b>148,885</b>
TOTAL OTHER DIRECT COSTS							<b>18,750,326</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>19,725,095</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							<b>274,905</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>20,000,000</b>
K. RESIDUAL FUNDS							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ <b>20,000,000</b> \$
M. COST SHARING PROPOSED LEVEL \$ <b>4,000,000</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Paul L Hill</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

C \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

**West Virginia Higher Education Policy Commission (HEPC)**  
**Budget Justification**

**A. Senior Personnel**

Support is requested for:

1. PI/Project Director (Hill, 6 months salary/yr): oversight for all aspects of the project.
2. Co-PI/Co Project Director (Taylor, 3 months salary/yr): supportive administrative role focusing on project implementation, reporting and evaluation.

Requested funding for salaries includes estimated 3% increases per year.

**B. Other Personnel**

1. Postdoctoral Associate: Support for one postdoctoral researcher position for Education/ Outreach and training in all aspects of EPSCoR project administration (\$44,500/year/postdoc) is requested. An increase of 3%/yr is budgeted.

**C. Fringe Benefits**

Fringe benefits for above noted personnel are requested.

**E. Travel**

Travel funding for 5 staff members to attend National NSF conferences (\$2,000/yr) and 3 staff members to attend 2 PD/PA meetings (\$2,000/yr per meeting) is requested. An additional \$4,000 is requested for external technical review board members to attend annual review meetings (5@\$800). A 2%-3% inflation factor has been calculated for each subsequent year.

**G. Other Direct Costs**

1. *Materials and supplies*: A cumulative amount of \$1,259 is requested for general offices supplies and materials.
2. *Publication Costs*: Support for the "Neuron" publication is requested (\$9,200/yr) with a 2%-3% inflation increase for subsequent years.
3. *Consultant Services*: Support for an External Evaluator is requested (\$60,000/yr) and five External Technical Advisory Board members (\$2,000 ea/yr) is requested with a 2%-3% inflation increase subsequent years.
5. *Sub awards*: Support for 3 sub awards (partner institutions) is as follows: \$5,624,846 (Marshall University), \$2,448,000 (West Virginia State University), and \$9,625,000 (West Virginia University). In addition, \$500,000 will be provided to PUI's and Community Colleges through a competitive grant process.
6. *Other*: Support for underwriting of the PBS television production *Outlook* is requested (\$27,000/yr). Meeting expenses for External Technical Advisory Board meetings is requested (\$2,750/yr). A 2%-3% inflation factor has been calculated for each subsequent year.

**I. Indirect Costs**

Indirect costs of 18% apply to all direct costs except equipment, participant support and sub awards.

**M. Cost Sharing**

A minimum of 20% of the total requested NSF funds will be provided as cost share by the institutions and the West Virginia Research Challenge Fund (administered by the West Virginia HEPC). The HEPC Division of Science and Research will use cost sharing funds to for administration including partial support for senior personnel, other personnel and communication/outreach projects such as the bi-annual STAR symposium, Nanooze (Nano display) and radio ads.

# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION <b>Marshall University Research Corporation</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>John Maher</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>John Maher - PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Brian Antonsen - Cellular Mechanisms Team</b>			0.00	0.00	1.00	<b>6,009</b>
3.	<b>Tina Cartwright - Outreach Team Leader</b>			0.00	0.00	1.00	<b>5,890</b>
4.	<b>Robin O'Keefe - Molecular Mechanisms Team</b>			0.00	0.00	1.00	<b>6,099</b>
5.	<b>Gary Schultz - Molecular Mechanisms Team</b>			0.00	0.00	1.00	<b>6,009</b>
6.	( 2 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	2.00	<b>12,667</b>
7.	( 7 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	0.00	6.00	<b>36,674</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 0 ) POST DOCTORAL SCHOLARS			0.00	0.00	0.00	<b>0</b>
2.	( 1 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	4.50	0.00	<b>36,000</b>
3.	( 17 ) GRADUATE STUDENTS						<b>107,000</b>
4.	( 0 ) UNDERGRADUATE STUDENTS						<b>0</b>
5.	( 1 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						<b>30,732</b>
6.	( 1 ) OTHER						<b>45,060</b>
TOTAL SALARIES AND WAGES (A + B)							<b>255,466</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>67,152</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>322,618</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
	<b>Roche 454 Genomic Sequencer</b>			\$		<b>424,900</b>	
TOTAL EQUIPMENT							<b>424,900</b>
E. TRAVEL							
	1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)						<b>8,000</b>
	2. FOREIGN						<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	<b>80,000</b>				
2.	TRAVEL		<b>11,000</b>				
3.	SUBSISTENCE		<b>4,000</b>				
4.	OTHER		<b>13,000</b>				
TOTAL NUMBER OF PARTICIPANTS ( 0 )							
TOTAL PARTICIPANT COSTS							<b>108,000</b>
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						<b>41,294</b>
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						<b>5,000</b>
3.	CONSULTANT SERVICES						<b>0</b>
4.	COMPUTER SERVICES						<b>0</b>
5.	SUBAWARDS						<b>0</b>
6.	OTHER						<b>6,000</b>
TOTAL OTHER DIRECT COSTS							<b>52,294</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>915,812</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>total direct costs less equip and stipends (Rate: 42.0000, Base: 410912)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>172,583</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>1,088,395</b>
K. RESIDUAL FUNDS							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							<b>\$ 1,088,395</b>
M. COST SHARING PROPOSED LEVEL \$ <b>217,679</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>John Maher</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

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### Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
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Trzyna, Wendy - Cellular Mechanisms Team	0.00	0.00	1.00	6182
Wang, Bin - Molecular Mechanisms Team	0.00	0.00	1.00	6485



# SUMMARY PROPOSAL BUDGET

YEAR **2**

ORGANIZATION <b>Marshall University Research Corporation</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>John Maher</b>				AWARD NO.	Proposed	Granted	
				A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)			
	CAL	ACAD	SUMR				
1. <b>John Maher - PI</b>	0.00	0.00	0.00	\$	<b>0</b>	\$	
2. <b>Brian Antonsen - Cellular Mechanisms Team</b>	0.00	0.00	1.00		<b>6,009</b>		
3. <b>Tina Cartwright - Outreach Team Leader</b>	0.00	0.00	1.00		<b>5,890</b>		
4. <b>MU New Hire - Cellular Mechanisms Team</b>	0.00	9.00	0.00		<b>54,000</b>		
5. <b>Robin O'Keefe - Molecular Mechanisms Team</b>	0.00	0.00	1.00		<b>6,099</b>		
6. ( <b>3</b> ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	3.00		<b>18,676</b>		
7. ( <b>8</b> ) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	9.00	6.00		<b>90,674</b>		
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>2</b> ) POST DOCTORAL SCHOLARS	12.00	0.00	0.00		<b>45,000</b>		
2. ( <b>3</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	6.00	4.50	0.00		<b>66,000</b>		
3. ( <b>17</b> ) GRADUATE STUDENTS					<b>107,000</b>		
4. ( <b>0</b> ) UNDERGRADUATE STUDENTS					<b>0</b>		
5. ( <b>1</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)					<b>30,732</b>		
6. ( <b>1</b> ) OTHER					<b>45,060</b>		
TOTAL SALARIES AND WAGES (A + B)					<b>384,466</b>		
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)					<b>111,219</b>		
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)					<b>495,685</b>		
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT						<b>0</b>	
E. TRAVEL					<b>10,000</b>		
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)					<b>10,000</b>		
2. FOREIGN					<b>0</b>		
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS	\$	<b>121,800</b>					
2. TRAVEL		<b>11,000</b>					
3. SUBSISTENCE		<b>4,000</b>					
4. OTHER		<b>13,000</b>					
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> )				TOTAL PARTICIPANT COSTS		<b>149,800</b>	
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES					<b>40,000</b>		
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION					<b>10,000</b>		
3. CONSULTANT SERVICES					<b>0</b>		
4. COMPUTER SERVICES					<b>0</b>		
5. SUBAWARDS					<b>0</b>		
6. OTHER					<b>87,000</b>		
TOTAL OTHER DIRECT COSTS					<b>137,000</b>		
H. TOTAL DIRECT COSTS (A THROUGH G)					<b>792,485</b>		
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>total direct less equipment and stipends (Rate: 42.0000, Base: 670685)</b>							
TOTAL INDIRECT COSTS (F&A)					<b>281,688</b>		
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)					<b>1,074,173</b>		
K. RESIDUAL FUNDS					<b>0</b>		
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)					\$ <b>1,074,173</b>	\$	
M. COST SHARING PROPOSED LEVEL \$ <b>214,835</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>John Maher</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 2

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### Other Senior Personnel

<b>Name - Title</b>	<b>Cal</b>	<b>Acad</b>	<b>Sumr</b>	<b>Funds Requested</b>	
Schultz, Gary - Molecular Mechanisms Team	0.00	0.00	1.00	6009	
Trzyna, Wendy - Cellular Mechanisms Team	0.00	0.00	1.00	6182	
Wang, Bin - Molecular Mechanisms Team	0.00	0.00	1.00	6485	

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# SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION <b>Marshall University Research Corporation</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>John Maher</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>John Maher - PI</b>				0.00	0.00	0.00	\$ <b>0</b>
2. <b>MU New Hire - Cellular Mechanisms Team</b>				0.00	9.00	0.00	<b>54,000</b>
3. <b>MU New Hire 2 - Molecular Mechanisms Team</b>				0.00	9.00	0.00	<b>54,000</b>
4.							
5.							
6. ( <b>0</b> ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	<b>0</b>
7. ( <b>3</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	18.00	0.00	<b>108,000</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>2</b> ) POST DOCTORAL SCHOLARS				12.00	0.00	0.00	<b>45,000</b>
2. ( <b>3</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				6.00	4.50	0.00	<b>66,000</b>
3. ( <b>17</b> ) GRADUATE STUDENTS							<b>107,000</b>
4. ( <b>0</b> ) UNDERGRADUATE STUDENTS							<b>0</b>
5. ( <b>1</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							<b>30,732</b>
6. ( <b>1</b> ) OTHER							<b>45,060</b>
TOTAL SALARIES AND WAGES (A + B)							<b>401,792</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>122,136</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>523,928</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							<b>0</b>
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							<b>5,000</b>
2. FOREIGN							<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <b>100,000</b>							
2. TRAVEL <b>11,000</b>							
3. SUBSISTENCE <b>4,000</b>							
4. OTHER <b>13,000</b>							
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> ) TOTAL PARTICIPANT COSTS							<b>128,000</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>40,000</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							<b>10,000</b>
3. CONSULTANT SERVICES							<b>0</b>
4. COMPUTER SERVICES							<b>0</b>
5. SUBAWARDS							<b>0</b>
6. OTHER							<b>112,000</b>
TOTAL OTHER DIRECT COSTS							<b>162,000</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>818,928</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>total direct less equipment and stipends (Rate: 42.0000, Base: 718927)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>301,949</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>1,120,877</b>
K. RESIDUAL FUNDS							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ <b>1,120,877</b> \$
M. COST SHARING PROPOSED LEVEL \$ <b>224,176</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>John Maher</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

# SUMMARY PROPOSAL BUDGET

YEAR 4

ORGANIZATION <b>Marshall University Research Corporation</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>John Maher</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>John Maher - PI</b>				0.00	0.00	0.00	\$ 0
2. <b>MU New Hire - Cellular Mechanisms Team</b>				0.00	9.00	0.00	54,000
3. <b>MU New Hire 2 - Molecular Mechanisms Team</b>				0.00	9.00	0.00	54,000
4.							
5.							
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( 3 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	18.00	0.00	108,000
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 2 ) POST DOCTORAL SCHOLARS				12.00	0.00	0.00	45,000
2. ( 3 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				6.00	4.50	0.00	66,000
3. ( 17 ) GRADUATE STUDENTS							107,000
4. ( 0 ) UNDERGRADUATE STUDENTS							0
5. ( 1 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							30,732
6. ( 1 ) OTHER							45,060
TOTAL SALARIES AND WAGES (A + B)							401,792
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							122,136
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							523,928
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL							10,000
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							10,000
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <u>100,000</u>							100,000
2. TRAVEL <u>11,000</u>							11,000
3. SUBSISTENCE <u>4,000</u>							4,000
4. OTHER <u>13,000</u>							13,000
TOTAL NUMBER OF PARTICIPANTS ( 0 )							
TOTAL PARTICIPANT COSTS							128,000
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							40,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							10,000
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							112,000
TOTAL OTHER DIRECT COSTS							162,000
H. TOTAL DIRECT COSTS (A THROUGH G)							823,928
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>total direct less equipment and stipends (Rate: 42.0000, Base: 723927)</b>							
TOTAL INDIRECT COSTS (F&A)							304,049
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							1,127,977
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 1,127,977 \$
M. COST SHARING PROPOSED LEVEL \$ <b>225,595</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>John Maher</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

# SUMMARY PROPOSAL BUDGET

YEAR 5

ORGANIZATION <b>Marshall University Research Corporation</b>				FOR NSF USE ONLY				
				PROPOSAL NO.	DURATION (months)			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>John Maher</b>				AWARD NO.				
				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. <b>John Maher - PI</b>				0.00	0.00	0.00	\$ 0	\$
2. <b>MU New Hire - Cellular Mechanisms Team</b>				0.00	9.00	0.00	54,000	
3. <b>MU New Hire 2 - Molecular Mechanisms Team</b>				0.00	9.00	0.00	54,000	
4.								
5.								
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0	
7. ( 3 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	18.00	0.00	108,000	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)								
1. ( 2 ) POST DOCTORAL SCHOLARS				12.00	0.00	0.00	90,000	
2. ( 3 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				10.00	4.50	1.00	90,000	
3. ( 17 ) GRADUATE STUDENTS							107,000	
4. ( 0 ) UNDERGRADUATE STUDENTS							0	
5. ( 1 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							30,732	
6. ( 1 ) OTHER							45,060	
TOTAL SALARIES AND WAGES (A + B)							470,792	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							138,309	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							609,101	
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)							10,000	
2. FOREIGN							0	
F. PARTICIPANT SUPPORT COSTS								
1. STIPENDS \$ 100,000								
2. TRAVEL 11,000								
3. SUBSISTENCE 4,000								
4. OTHER 13,000								
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS							128,000	
G. OTHER DIRECT COSTS								
1. MATERIALS AND SUPPLIES							40,000	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							10,000	
3. CONSULTANT SERVICES							0	
4. COMPUTER SERVICES							0	
5. SUBAWARDS							0	
6. OTHER							87,000	
TOTAL OTHER DIRECT COSTS							137,000	
H. TOTAL DIRECT COSTS (A THROUGH G)							884,101	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) total direct less equipment and stipends (Rate: 42.0000, Base: 784102)								
TOTAL INDIRECT COSTS (F&A)							329,323	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							1,213,424	
K. RESIDUAL FUNDS							0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 1,213,424	\$
M. COST SHARING PROPOSED LEVEL \$ 242,685				AGREED LEVEL IF DIFFERENT \$				
P/PI NAME <b>John Maher</b>				FOR NSF USE ONLY				
				INDIRECT COST RATE VERIFICATION				
ORG. REP. NAME*				Date Checked	Date Of Rate Sheet	Initials - ORG		

# SUMMARY PROPOSAL BUDGET Cumulative

ORGANIZATION <b>Marshall University Research Corporation</b>				FOR NSF USE ONLY		
				PROPOSAL NO.	DURATION (months)	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>John Maher</b>				AWARD NO.	Proposed	Granted
					NSF Funded Person-months	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				CAL	ACAD	SUMR
1. <b>John Maher - PI</b>				0.00	0.00	0.00
2. <b>Brian Antonsen - Cellular Mechanisms Team</b>				0.00	0.00	2.00
3. <b>Tina Cartwright - Outreach Team Leader</b>				0.00	0.00	2.00
4. <b>MU New Hire - Cellular Mechanisms Team</b>				0.00	36.00	0.00
5. <b>MU New Hire 2 - Molecular Mechanisms Team</b>				0.00	27.00	0.00
6. ( 4 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	8.00
7. ( 9 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	63.00	12.00
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 8 ) POST DOCTORAL SCHOLARS				48.00	0.00	0.00
2. ( 13 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				28.00	22.50	1.00
3. ( 85 ) GRADUATE STUDENTS						
4. ( 0 ) UNDERGRADUATE STUDENTS						
5. ( 5 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						
6. ( 5 ) OTHER						
TOTAL SALARIES AND WAGES (A + B)						
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)						
\$ 424,900						
TOTAL EQUIPMENT						
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)						
2. FOREIGN						
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ 501,800						
2. TRAVEL 55,000						
3. SUBSISTENCE 20,000						
4. OTHER 65,000						
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS						
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						
3. CONSULTANT SERVICES						
4. COMPUTER SERVICES						
5. SUBAWARDS						
6. OTHER						
TOTAL OTHER DIRECT COSTS						
H. TOTAL DIRECT COSTS (A THROUGH G)						
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)						
TOTAL INDIRECT COSTS (F&A)						
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						
K. RESIDUAL FUNDS						
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						
M. COST SHARING PROPOSED LEVEL \$ 1,124,970				AGREED LEVEL IF DIFFERENT \$		
PI/PI NAME <b>John Maher</b>				FOR NSF USE ONLY		
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION		
				Date Checked	Date Of Rate Sheet	Initials - ORG

C \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

## Marshall University Budget Justification

### **A. Senior Personnel:**

**Year 1:** We are requesting NSF funds to cover the summer salaries (1 month in all cases) for 6 junior faculty (*Wang, Schultz, Antonsen, Trzyna, O'Keefe and Cartwright*). Salary for 3 additional senior faculty will be provided as in-kind institutional match as mentors to these junior faculty.

**Year 2:** A new faculty will be hired in Year 2. The ideal candidate will have expertise in organismal development and will serve to fill a collaborative need in this discipline. This position will have its tenure home in the Department of Biology in the College of Science. NSF funds are requested for 9 academic months; summer salary for this position will be cost-share from the State of West Virginia Research Challenge Fund (WVRCF).

**Year 3:** A second new faculty search will begin in Year 2 with the individual in place by the start of Year 3. The ideal candidate will have expertise in molecular mechanisms underlying cellular differentiation. This position will have its tenure home in the Department of Biology in the College of Science. NSF funds are requested for 9 academic months; summer salary for this position will be cost-share from the WVRCF. Summer salary for existing junior faculty will cease as they will be expected to have become externally funded by this time.

**Year 4 & 5:** Same as Year 3

### **B. Other Personnel:**

In Year 1, one postdoc and one research technician will be hired to support the research programs, with funds coming from the WVRCF as cost-share. The requested salary is nationally competitive, in line with NIH and NSF scale, and will attract highly-motivated postdoctoral trainees, who will contribute immeasurably to the research effort. Since these individuals are expected to be exceptional young researchers, it is reasonable to expect them to compete for individual fellowships which, when successful, will free monies for additional postdoctoral recruits. We plan to aggressively recruit doctoral graduates from Historically Black Colleges and Universities. The Research Technician will devote a full-time, 12 calendar month effort to this project. The salary is in accord with the competitive wage for research staff at Marshall and other comparable institutions in West Virginia.

In Years 2-5 we are adding a second postdoc and second research assistant, bringing the total to two of each position per year as research activities expand. NSF funds are being requested to provide partial support for these positions with additional funds from the WVRCF as cost-share.

NSF funds for one (1) College of Education Graduate Student (\$1,000 for 11 months) and sixteen (16) College of Science Graduate Students/Teaching Assistants (\$1,000 for 9 months) is requested. The funds requested will support these graduate students, as Graduate Research Assistants, who will provide a substantial component to the hands-on research required by the faculty of this proposal to be nationally competitive.

NSF funds for a Research Associate is requested to provide technical support for the instrumentation associated with this program, especially the Roche 454 DNA sequencer. Since this is a service position, it is not reasonable to assume that a postdoc trainee should fill this role. The RA will devote a full-time, 12 calendar month effort to this project, with partial support being provided as cost-share by the WVRCF.

An Administrative Associate will devote a 12 calendar month effort to this project and the salary requested is in accord with Marshall University pay scale. This position will track expenditures, monitor

hiring compliance, participate in pre-award grant preparations, and assist in maintenance of Team meeting schedules and seminars.

Education/Outreach Coordinator: A full-time staff member will be recruited to coordinate, organize, and implement the Education plans associated with this supplement. This position will report to Dr. Tina Cartwright. An additional \$11,060 per year is requested to cover faculty salaries in 0.5 month increments as compensation for participating in the TREK program (education program).

**C. Fringe Benefits:** MU's fringe benefit rates are 30% (academic year salary) and 17.5% (summer) for faculty and postdocs; 17% plus \$984/month for research technicians and associates; and 7.65% for graduate students.

**D. Equipment:** \$424,900 is requested to cover the purchase of a Roche 454 Genome Sequencer FLX Instrument, capable of sequencing up to one billion bases in a 24 hour period (Purchase cost is \$524,900; \$100,000 in matching funds will be provided by the WVRCF). This state-of-the-art instrument will facilitate the genotype/phenotype analyses of this effort. Service contracts following the initial warranty period will be covered by institute resources.

**E. Travel:** \$8,000 is requested for domestic travel for faculty, postdoc, and graduate student attendance at meetings. Team members will be encouraged to attend national meetings in order to develop collaborations and gain new knowledge that will enhance grant submissions. Additional funds will cover automobile travel to Morgantown, WV (location of West Virginia University, 200 miles from Marshall University) to meet with WVNano collaborators, and travel across the state to meet and encourage researchers from West Virginia's PUIs to collaborate with Marshall scientists. Additional travel monies will be provided by WVRCF.

**F. Participant Support Costs:** These costs constitute funds required to support the Outreach Plan that has been developed to address specific strengths and needs at Marshall and the surrounding community.

A cumulative amount of \$501,800 is requested for stipends for the TREK and LA program. The stipends for TREK cover 4 teachers and 8 students for 8 weeks; for the LA program -15 participants for four years. An additional \$140,000 is requested for travel (\$55,000), subsistence (\$20,000), supplies (\$50,000) and mini grants (\$15,000).

**G. Other Direct Costs:** Materials and Supplies are requested in the amount of \$201,294 to cover expenses for research supplies for cellular and molecular faculty teams. An additional \$18,162 will be derived from the WVRCF.

\$45,000 is requested to cover the publication costs and \$54,000 for outreach advertising and recruiting costs. Advertisements will be placed in research journals (e.g. *Science*) that will target postdoctoral trainees and research technicians. Although research technicians are usually recruited from local pools of talent, positions for both postdocs and technicians will be simultaneously posted in order to effectively recruit young professional couples.

\$175,000 for start-up packages for each new Faculty hire is requested and will be paid in allotments over the course of three years.



**I. Indirect Costs:** F&A amounts are calculated at 42% of modified total direct costs (less equipment and stipends). This rate is Marshall University's federally negotiated rate with the US Department of Health and Human Services (agreement dated 05/11/04).

**M. Cost Sharing**

A minimum of 20% of the total requested NSF funds will be provided as cost share by Marshall University and the West Virginia Research Challenge Fund (administered by the West Virginia Higher Education Policy Commission). The cost share will provide partial support for senior personnel, other personnel, Graduate Student Tuition Waivers, equipment and partial start up funds for new faculty.

# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION <b>West Virginia State University</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Jose Ulises Toledo</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Jose Ulises Toledo - Associate Dean, co-PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Sean Collins - Cellular Genomics/Epigenetic</b>			0.00	0.00	1.00	6,333
3.	<b>Gerald Hankins - Cellular Develop/Cell Signal</b>			0.00	0.00	1.00	6,333
4.	<b>WVSU New Hire - Bioinformatics specialist</b>			0.00	0.00	0.00	0
5.							
6.	( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	0
7.	( 4 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	0.00	2.00	12,666
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 0 ) POST DOCTORAL SCHOLARS			0.00	0.00	0.00	0
2.	( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	0
3.	( 4 ) GRADUATE STUDENTS						30,000
4.	( 4 ) UNDERGRADUATE STUDENTS						24,000
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6.	( 2 ) OTHER						33,834
TOTAL SALARIES AND WAGES (A + B)							100,500
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							20,890
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							121,390
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.) <b>see budget justification</b>							
							\$ 220,157
TOTAL EQUIPMENT							220,157
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							13,530
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						50,000
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						6,800
3.	CONSULTANT SERVICES						0
4.	COMPUTER SERVICES						0
5.	SUBAWARDS						0
6.	OTHER						25,000
TOTAL OTHER DIRECT COSTS							81,800
H. TOTAL DIRECT COSTS (A THROUGH G)							436,877
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>total salaries &amp; fringe (Rate: 52.0000, Base: 121390)</b>							
TOTAL INDIRECT COSTS (F&A)							63,123
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							500,000
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 500,000
M. COST SHARING PROPOSED LEVEL \$ 100,000				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Jose Ulises Toledo</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

# SUMMARY PROPOSAL BUDGET

YEAR **2**

ORGANIZATION <b>West Virginia State University</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Jose Ulises Toledo</b>				AWARD NO.	Proposed	Granted	
				A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)			
	CAL	ACAD	SUMR				
1. <b>Jose Ulises Toledo - Associate Dean, co-PI</b>	0.00	0.00	0.00	\$	<b>0</b>	\$	
2. <b>Sean Collins - Cellular Genomics/Epigenetic</b>	0.00	0.00	1.00		<b>6,523</b>		
3. <b>Gerald Hankins - Cellular Develop/Cell Signal</b>	0.00	0.00	1.00		<b>6,523</b>		
4. <b>WVSU New Hire - Bioinformatics specialist</b>	0.00	0.00	0.00		<b>68,000</b>		
5.							
6. ( <b>0</b> ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00		<b>0</b>		
7. ( <b>4</b> ) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	2.00		<b>81,046</b>		
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>0</b> ) POST DOCTORAL SCHOLARS	0.00	0.00	0.00		<b>0</b>		
2. ( <b>0</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00		<b>0</b>		
3. ( <b>4</b> ) GRADUATE STUDENTS					<b>30,000</b>		
4. ( <b>4</b> ) UNDERGRADUATE STUDENTS					<b>24,000</b>		
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)					<b>0</b>		
6. ( <b>2</b> ) OTHER					<b>34,848</b>		
TOTAL SALARIES AND WAGES (A + B)					<b>169,894</b>		
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)					<b>43,714</b>		
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)					<b>213,608</b>		
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT					<b>0</b>		
E. TRAVEL					<b>13,530</b>		
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							
2. FOREIGN					<b>0</b>		
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS	\$	<b>29,850</b>					
2. TRAVEL		<b>5,004</b>					
3. SUBSISTENCE		<b>0</b>					
4. OTHER		<b>41,850</b>					
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> )				TOTAL PARTICIPANT COSTS	<b>76,704</b>		
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES					<b>50,000</b>		
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION					<b>6,800</b>		
3. CONSULTANT SERVICES					<b>0</b>		
4. COMPUTER SERVICES					<b>0</b>		
5. SUBAWARDS					<b>0</b>		
6. OTHER					<b>18,282</b>		
TOTAL OTHER DIRECT COSTS					<b>75,082</b>		
H. TOTAL DIRECT COSTS (A THROUGH G)					<b>378,924</b>		
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>total salaries &amp; fringe (Rate: 52.0000, Base: 213608)</b>							
TOTAL INDIRECT COSTS (F&A)					<b>111,076</b>		
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)					<b>490,000</b>		
K. RESIDUAL FUNDS					<b>0</b>		
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				\$	<b>490,000</b>	\$	
M. COST SHARING PROPOSED LEVEL \$ <b>98,000</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Jose Ulises Toledo</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

# SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION <b>West Virginia State University</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Jose Ulises Toledo</b>				AWARD NO.	Proposed	Granted	
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		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Jose Ulises Toledo - Associate Dean, co-PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Sean Collins - Cellular Genomics/Epigenetic</b>			0.00	0.00	1.00	6,719
3.	<b>Gerald Hankins - Cellular Develop/Cell Signal</b>			0.00	0.00	1.00	6,719
4.	<b>WVSU New Hire - Bioinformatics specialist</b>			0.00	0.00	0.00	70,040
5.							
6.	( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	0
7.	( 4 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	0.00	2.00	83,478
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 0 ) POST DOCTORAL SCHOLARS			0.00	0.00	0.00	0
2.	( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	0
3.	( 4 ) GRADUATE STUDENTS						30,000
4.	( 4 ) UNDERGRADUATE STUDENTS						24,000
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6.	( 2 ) OTHER						35,894
TOTAL SALARIES AND WAGES (A + B)							173,372
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							44,782
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							218,154
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)							13,530
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	29,850				
2.	TRAVEL		5,003				
3.	SUBSISTENCE		0				
4.	OTHER		41,850				
TOTAL NUMBER OF PARTICIPANTS ( 0 )				TOTAL PARTICIPANT COSTS			76,703
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						50,000
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						6,800
3.	CONSULTANT SERVICES						0
4.	COMPUTER SERVICES						0
5.	SUBAWARDS						0
6.	OTHER						6,373
TOTAL OTHER DIRECT COSTS							63,173
H. TOTAL DIRECT COSTS (A THROUGH G)							371,560
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>total salaries &amp; fringe (Rate: 52.0000, Base: 218154)</b>							
TOTAL INDIRECT COSTS (F&A)							113,440
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							485,000
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 485,000 \$
M. COST SHARING PROPOSED LEVEL \$ 97,000				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Jose Ulises Toledo</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

# SUMMARY PROPOSAL BUDGET

YEAR 4

ORGANIZATION <b>West Virginia State University</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Jose Ulises Toledo</b>				AWARD NO.	Proposed	Granted	
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		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Jose Ulises Toledo - Associate Dean, co-PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Sean Collins - Cellular Genomics/Epigenetic</b>			0.00	0.00	1.00	6,921
3.	<b>Gerald Hankins - Cellular Develop/Cell Signal</b>			0.00	0.00	1.00	6,921
4.	<b>WVSU New Hire - Bioinformatics specialist</b>			0.00	0.00	0.00	72,141
5.							
6.	( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	0
7.	( 4 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	0.00	2.00	85,983
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 0 ) POST DOCTORAL SCHOLARS			0.00	0.00	0.00	0
2.	( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	0
3.	( 4 ) GRADUATE STUDENTS						30,000
4.	( 4 ) UNDERGRADUATE STUDENTS						24,000
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6.	( 2 ) OTHER						36,970
TOTAL SALARIES AND WAGES (A + B)							176,953
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							45,882
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							222,835
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)							12,788
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	29,850				
2.	TRAVEL		5,003				
3.	SUBSISTENCE		0				
4.	OTHER		41,850				
TOTAL NUMBER OF PARTICIPANTS ( 0 )				TOTAL PARTICIPANT COSTS			76,703
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							50,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							6,800
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							56,800
H. TOTAL DIRECT COSTS (A THROUGH G)							369,126
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>total salaries &amp; fringe (Rate: 52.0000, Base: 222835)</b>							
TOTAL INDIRECT COSTS (F&A)							115,874
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							485,000
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 485,000 \$
M. COST SHARING PROPOSED LEVEL \$ 97,000				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Jose Ulises Toledo</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

# SUMMARY PROPOSAL BUDGET

YEAR 5

ORGANIZATION <b>West Virginia State University</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Jose Ulises Toledo</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Jose Ulises Toledo - Associate Dean, co-PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Sean Collins - Cellular Genomics/Epigenetic</b>			0.00	0.00	1.00	7,128
3.	<b>Gerald Hankins - Cellular Develop/Cell Signal</b>			0.00	0.00	1.00	7,128
4.	<b>WVSU New Hire - Bioinformatics specialist</b>			0.00	0.00	0.00	74,305
5.							
6.	( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	0
7.	( 4 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	0.00	2.00	88,561
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 0 ) POST DOCTORAL SCHOLARS			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.	( 4 ) UNDERGRADUATE STUDENTS						24,000
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6.	( 2 ) OTHER						38,080
TOTAL SALARIES AND WAGES (A + B)							150,641
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							42,516
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							193,157
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.) <b>see budget justification</b>							
							\$ 29,843
TOTAL EQUIPMENT							29,843
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							14,273
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	29,850				
2.	TRAVEL		5,003				
3.	SUBSISTENCE		0				
4.	OTHER		41,850				
TOTAL NUMBER OF PARTICIPANTS ( 0 )							
TOTAL PARTICIPANT COSTS							76,703
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						50,000
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						6,800
3.	CONSULTANT SERVICES						0
4.	COMPUTER SERVICES						0
5.	SUBAWARDS						0
6.	OTHER						16,782
TOTAL OTHER DIRECT COSTS							73,582
H. TOTAL DIRECT COSTS (A THROUGH G)							387,558
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>total salaries &amp; fringe (Rate: 52.0000, Base: 193157)</b>							
TOTAL INDIRECT COSTS (F&A)							100,442
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							488,000
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 488,000
M. COST SHARING PROPOSED LEVEL \$ 97,600				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Jose Ulises Toledo</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet			Initials - ORG	

# SUMMARY PROPOSAL BUDGET Cumulative

ORGANIZATION <b>West Virginia State University</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Jose Ulises Toledo</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Jose Ulises Toledo - Associate Dean, co-PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Sean Collins - Cellular Genomics/Epigenetic</b>			0.00	0.00	5.00	33,624
3.	<b>Gerald Hankins - Cellular Develop/Cell Signal</b>			0.00	0.00	5.00	33,624
4.	<b>WVSU New Hire - Bioinformatics specialist</b>			0.00	0.00	0.00	284,486
5.							
6.	( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	0
7.	( 4 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	0.00	10.00	351,734
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 0 ) POST DOCTORAL SCHOLARS			0.00	0.00	0.00	0
2.	( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	0
3.	( 16 ) GRADUATE STUDENTS						120,000
4.	( 20 ) UNDERGRADUATE STUDENTS						120,000
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6.	( 10 ) OTHER						179,626
TOTAL SALARIES AND WAGES (A + B)							771,360
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							197,784
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							969,144
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
							\$ 250,000
TOTAL EQUIPMENT							250,000
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							67,651
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	119,400				
2.	TRAVEL		20,013				
3.	SUBSISTENCE		0				
4.	OTHER		167,400				
TOTAL NUMBER OF PARTICIPANTS ( 0 )							
TOTAL PARTICIPANT COSTS							306,813
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						250,000
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						34,000
3.	CONSULTANT SERVICES						0
4.	COMPUTER SERVICES						0
5.	SUBAWARDS						0
6.	OTHER						66,437
TOTAL OTHER DIRECT COSTS							350,437
H. TOTAL DIRECT COSTS (A THROUGH G)							1,944,045
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							503,955
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							2,448,000
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 2,448,000
M. COST SHARING PROPOSED LEVEL \$ 489,600				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Jose Ulises Toledo</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet			Initials - ORG	

C \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

**West Virginia State University  
Budget Justification**

**A. Senior Personnel**

Support is requested for:

1. Sean Collins, an Assistant Professor of biology conducts research in the insect physiology and molecular biology. One summer month salary is requested for Dr. Collins for 5 years. In addition, 2.5 month summer and 2.5 month academic salary time distributed during the length of this grant (5 years) is also offered as an institutional match.
2. Gerald Hankins, an Assistant Professor of biology and conducts research in the area of functional genomics and cell mechanotransduction. One summer month salary is requested for Dr. Hankins for 5 years. In addition, 2.5 month summer and 2.5 month academic salary time distributed during the length of this grant (5 years) is offered as an institutional match.
3. New Hire, a faculty with expertise in Computational Biology (Bioinformatics) is being proposed starting in Year 2. The new hire will be in charge of the new computer visualization room being developed at the University (RII-Track 2 grant), its associated training, and engage in educational and mentoring activities comprised in this project. Funding is requested for 9.6 calendar months for 4 years. The remaining salary will be offered as match.

Requested funding for salaries includes a 3% increase per year.

Salary for four additional senior faculty will be provided institutional match as mentors to these junior faculty.

**B. Other Personnel**

1. Graduate Students (4) will be selected for participation in research groups. Two graduate students will be selected for the first 2 years, and 3 more will be supported in the 3<sup>rd</sup> and 4<sup>th</sup> years of this grant. Two graduate students will be assigned to senior faculty; the other 3 students will be assigned to the junior faculty and new hire. These graduate students will be required to complete a thesis in research closely related to the seed theme.
2. Undergraduate Students (4) will be hired to support year-long laboratory activities (academic as well as summer calendar). 2 students will be assigned to each research core area.
3. Other: Support for an Education/Outreach Campus Coordinator will be hired to provide day-to-day operation of the programs, support functions, and activities of the program. The coordinator will be engaged with this program at .5 FTE annually during the life of this program.

A Faculty Advisor with background in Education will be contracted to teach the 2 credit hour pedagogy course which will be required for all Learning Assistants to prepare them for the active-learning teaching strategies critical for student success in the STEM courses. This faculty will have a course buy out (\$2,000 per semester) and one summer month of their time (\$6,334) to collaborate with the research faculty on both implementation and research on programmatic impacts

**C. Fringe Benefits:** WVSU's fringe benefit rates are 33% (calendar year salary); 21% (summer salary); and 15% for graduate and undergraduate students.



#### D. Equipment

Instrumentation to support the cellular and molecular research including microarray and polyploidy research activities include: Nimblegen MS 200 Microarray Scanner (\$80,000); NimbleGen Microarray Dryer (\$10,000); NimbleGen Hybridization System (\$15,000); Nanodrop ND-8000 8 sample spectrophotometer (\$20,000) and Agilent 5975C Series GC/MSD [gas chromatograph/mass spectrometer] (\$85,000) and a LightCycler 480 Real-Time PCR System [Roche] (\$35,000).

#### E. Travel

Travel to attend annual professional conferences and in state meetings related to the state initiative and collaborative work for all 6 faculty members and 2 leading administrators is requested:

Out of state travel (Sub-Total \$39,600)

Lodging: 3 days avg. \* \$125.00 \* 8 faculty/admin \* 5 years = \$15,000

Transportation: 8 roundtrips/faculty \* \$450.00 \* 5 years = \$18,000

Per Diem 3 days avg. \* \$55.00 \* 8 faculty \* 5 years = \$6,600

In state travel (Sub-Total \$28,050)

Lodging: 3 trips/meeting/year \* 1.5 days avg. \* \$100.00 \* 8 faculty/admin \* 5 years = \$18,000

Transportation: 3 trips/meeting/year \* \$250.00 \* 5 years = \$3,750

Per Diem 3 trips/meeting/year \* 1.5 days avg. \* \$35.00 \* 8 faculty/admin \* 5 years = \$6,300

#### F. Participant Support Costs

3 Faculty Members from the College of Natural Science and Mathematics (CONSM) at WVSU will be contracted out to coordinate the learning experiences of the teachers involved with the Teacher Research Experience for advancing Knowledge (TREK) during 8 summer weeks. The faculty members will design an authentic research experience for the teachers and the accompanying students, supervise all research activities associated with the experiences, and participate in evaluation and follow-up throughout the year. 2 summer months \* \$10,000 \* 3 faculty \* 4 years = \$120,000

2 Education major undergraduate students will participate in the Learning Assistant program to serve as learning assistants for the program. They will lead learning teams of 4 to 5 student in regular meeting to improve on the teaching process. They will receive a stipend of \$1,500 a semester to work 10 hours per week. 2 Students \* \$1,500 \* 2 semesters \* 4 years = \$24,000

3 TREK Program Teachers will participate and receive a stipend of \$150/day for 5 days per week for the 8 weeks total of the grant. Additionally, they will receive a stipend at the same rate for the three day workshop at the end of their experience. 3 teachers \* 43 days \* \$150 \* 4 years = \$77,400

3 Selected High School Students will accompany the 3 TREK program teachers. These students will be participating in an authentic research experience at WVSU with the purpose of motivating them to pursue a STEM major related to the seed theme. Each student will receive a summer stipend of \$1,500 for their 8 weeks of research experience. 3 students \* \$1,500 \* 4 years = \$18,000

Supporting learning materials and other resources for 20 students in the Learning Assistants program and at WVSU will provided at \$500 per student. \$500 \* 20 students \* 4 years = \$40,000

Travel resources (10 trips annually) to facilitate interactions with other campuses, attend training, and support student enrichment activities is requested for faculty and staff at an average of \$260 per each trip. These trips will include on-going support of k-12 teachers who have participated in the TREK program and other teachers throughout central and southern WV. 10 trips \* \$260 \* 4 years = \$10,400

Travel resources for 3 teachers are requested to participate in the TREK program three-day workshop at the end of the program with Marshall and WVU. Expense expected at \$540 per rooms for the workshop, \$105 per diem, \$156 mileage for a total of \$801 per teacher.  $3 \text{ teachers} * \$801 * 4 \text{ Years} = \$9,612$

1 Program Leaders (Reviewers) of other successful Learning Assistant-style efforts from around the country will be invited to WVSU to facilitate adoption and learn best practices. These specialists will visit all 3 campuses every year to review our educational programs and make recommendations for program development, improvement, and refinements.  $1 \text{ program leaders with a } \$600 \text{ flight, } \$300 \text{ rental car, } \$150 \text{ hotel for } 4 \text{ nights, } \$70 \text{ Per Diem for } 5 \text{ days, for } 4 \text{ years} = \$7,400$

#### **G. Other Direct Costs**

1. Supplies: Supplies for sequencing and microarray experimentation are requested for the genomics and epigenetic research core at \$25,000 per year for 5 years. Also supplies for the microbial genomics and environmental bioengineering to conduct sequencing, anaerobic digestion experimentation and chemical analyses is requested at \$25,000 annually for 5 years.  $\$50,000 \text{ annual supplies} * 5 \text{ years} = \$250,000$

2. Publication Costs: A request is made for resources to assist faculty and students with posters and written materials needed for conferences, publications to publish results, and to promote public awareness of our programs. \$850 will be allocated to each key personnel including administrators.  $8 \text{ key personnel} * \$850 \text{ annual} * 5 \text{ years} = \$34,000$

3. Start-up Costs: A start up package for the 2 new hires is proposed for the establishment of their labs including lab-ware, renovations, and research equipment. Dr. Smith will receive \$80,000 during the 1<sup>st</sup> and 2<sup>nd</sup> years; the second new hire (Computational Biologists/Bioengineer) will receive \$150,000 during the 3<sup>rd</sup> and 4<sup>th</sup> years of this grant.  $\text{Total Requested} = \$67,116$

#### **I. Indirect Costs (Facilities and Administrative Costs)**

The provisional 52% DHHS negotiated rate at WVSU for indirect (F&A) is currently based on total salaries and wages (S&W). The indirect cost of \$503,955.86 was obtained by multiplying all salaries and wages by 52% ( $\$969,145.89 * 0.52$ ).

#### **M. Cost Sharing**

A minimum of 20% of the total requested NSF funds will be provided as cost share by the institution and the West Virginia Research Challenge Fund (administered by the West Virginia Higher Education Policy Commission). The cost share will provide partial support for senior personnel and other personnel.

# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION <b>West Virginia University Research Corporation</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Curt M Peterson</b>				AWARD NO.	Proposed	Granted	
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		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Curt M Peterson - PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Jeffrey Carver - TREK coordinator</b>			0.00	0.00	1.00	6,222
3.	<b>Pete Gannett - IRT2 Project Leader</b>			0.00	0.00	0.50	6,872
4.	<b>Lisa Holland - Bioresearch/Grad Program coord</b>			0.00	0.00	1.00	7,866
5.	<b>Kasi Jackson - LA Program coordinator</b>			0.00	0.00	1.00	5,393
6.	( 12 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	5.00	8.00	119,554
7.	( 17 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	5.00	11.50	145,907
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 3 ) POST DOCTORAL SCHOLARS			30.00	0.00	0.00	112,000
2.	( 2 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	75,292
3.	( 16 ) GRADUATE STUDENTS						355,000
4.	( 2 ) UNDERGRADUATE STUDENTS						15,000
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6.	( 2 ) OTHER						47,700
TOTAL SALARIES AND WAGES (A + B)							750,899
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							121,224
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							872,123
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
	<b>cyberinfrastructure facility equipment</b>		\$			66,666	
	<b>dynamic light scattering</b>					46,667	
	<b>inverted fluorescent microscope</b>					20,000	
	<b>Others (See Budget Comments Page...)</b>					389,366	
TOTAL EQUIPMENT							522,699
E. TRAVEL							29,000
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							
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						54,000
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3.	CONSULTANT SERVICES						0
4.	COMPUTER SERVICES						10,000
5.	SUBAWARDS						0
6.	OTHER						0
TOTAL OTHER DIRECT COSTS							64,000
H. TOTAL DIRECT COSTS (A THROUGH G)							1,487,822
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>total direct minus equipment (Rate: 46.5000, Base: 965124)</b>							
TOTAL INDIRECT COSTS (F&A)							448,783
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							1,936,605
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 1,936,605 \$
M. COST SHARING PROPOSED LEVEL \$ <b>387,321</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Curt M Peterson</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked		Date Of Rate Sheet		Initials - ORG	

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

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### Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
Lederman, David - Technical PI	0.00	0.00	1.00	10800
Lewis, James - Cyber. Facility coordinator	0.00	0.00	0.50	4378
Miller, Paul - EHRDO teaching faculty	0.00	0.00	1.00	4666
Ratcliff, Betsy - EHRDO teaching faculty	0.00	0.00	1.00	5927
Rojanasakul, Yon - IRT3 Project Leader	0.00	0.00	0.50	5000
TBD, WVU New Hire - WVNano Director	0.00	4.50	0.00	54000
TBD 1, WVU EHRDO - LA program physics	0.00	0.00	1.00	6555
TBD 1, WVU Seed Proj - faculty	0.00	0.00	1.00	10000
TBD 2, WVU EHRDO - TREK	0.00	0.50	0.00	3500
TBD 3, WVU EHRDO - TREK	0.00	0.00	0.50	3500
Timperman, Aaron - IRT1 Project Leader	0.00	0.00	0.50	4006
Toth, Eva E - EHRDO researcher/evaluator	0.00	0.00	1.00	7222

### \*\* D- Equipment

mass spectrometer (Amount: \$ 266667)

micro/nano equipment (Amount: \$ 122699)

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# SUMMARY PROPOSAL BUDGET

YEAR **2**

ORGANIZATION <b>West Virginia University Research Corporation</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Curt M Peterson</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Curt M Peterson - PI</b>			0.00	0.00	0.00	\$ <b>0</b>
2.	<b>Jeffrey Carver - TREK coordinator</b>			0.00	0.00	1.00	<b>6,409</b>
3.	<b>Pete Gannett - IRT2 Project Leader</b>			0.00	0.00	0.50	<b>7,078</b>
4.	<b>Lisa Holland - Bioresearch/Grad Program coord</b>			0.00	0.00	1.00	<b>8,102</b>
5.	<b>Kasi Jackson - LA Program coordinator</b>			0.00	0.00	1.00	<b>5,555</b>
6.	( <b>12</b> ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	5.00	8.00	<b>123,141</b>
7.	( <b>17</b> ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	5.00	11.50	<b>150,285</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( <b>3</b> ) POST DOCTORAL SCHOLARS			30.00	0.00	0.00	<b>115,360</b>
2.	( <b>2</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	<b>59,629</b>
3.	( <b>19</b> ) GRADUATE STUDENTS						<b>473,320</b>
4.	( <b>2</b> ) UNDERGRADUATE STUDENTS						<b>13,725</b>
5.	( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						<b>0</b>
6.	( <b>2</b> ) OTHER						<b>56,341</b>
TOTAL SALARIES AND WAGES (A + B)							<b>868,660</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>128,730</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>997,390</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
	<b>Cell Culture Facility 1</b>					<b>\$ 113,467</b>	
TOTAL EQUIPMENT							<b>113,467</b>
E. TRAVEL							<b>39,000</b>
	1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)						<b>39,000</b>
	2. FOREIGN						<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS \$ <b>75,000</b>						
2.	TRAVEL <b>6,138</b>						
3.	SUBSISTENCE <b>1,980</b>						
4.	OTHER <b>101,000</b>						
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> )							
TOTAL PARTICIPANT COSTS							<b>184,118</b>
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						<b>84,103</b>
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						<b>0</b>
3.	CONSULTANT SERVICES						<b>0</b>
4.	COMPUTER SERVICES						<b>8,000</b>
5.	SUBAWARDS						<b>0</b>
6.	OTHER						<b>0</b>
TOTAL OTHER DIRECT COSTS							<b>92,103</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>1,426,078</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>total direct minus equipment (Rate: 46.5000, Base: 1128493)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>524,749</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>1,950,827</b>
K. RESIDUAL FUNDS							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ <b>1,950,827</b> \$
M. COST SHARING PROPOSED LEVEL \$ <b>390,166</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Curt M Peterson</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked		Date Of Rate Sheet		Initials - ORG	

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 2

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### Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
Lederman, David - Technical PI	0.00	0.00	1.00	11124
Lewis, James - Cyber. Facility coordinator	0.00	0.00	0.50	4509
Miller, Paul - EHRDO teaching faculty	0.00	0.00	1.00	4807
Ratcliff, Betsy - EHRDO teaching faculty	0.00	0.00	1.00	6104
Rojanasakul, Yon - IRT3 Project Leader	0.00	0.00	0.50	5150
TBD, WVU New Hire - WVNano Director	0.00	4.50	0.00	55620
TBD 1, WVU EHRDO - A program -physics	0.00	0.00	1.00	6752
TBD 1, WVU Seed Proj - faculty	0.00	0.00	1.00	10300
TBD 2, WVU EHRDO - TREK	0.00	0.50	0.00	3605
TBD 3, WVU EHRDO - TREK	0.00	0.00	0.50	3605
Timperman, Aaron - IRT1 Project Leader	0.00	0.00	0.50	4126
Toth, Eva E - EHRDO researcher/evaluator	0.00	0.00	1.00	7439

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# SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION <b>West Virginia University Research Corporation</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Curt M Peterson</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Curt M Peterson - PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Jeffrey Carver - TREK coordinator</b>			0.00	0.00	1.00	<b>6,601</b>
3.	<b>Pete Gannett - IRT2 Project Leader</b>			0.00	0.00	0.50	<b>7,291</b>
4.	<b>Lisa Holland - Bioresearch/Grad Program coord</b>			0.00	0.00	1.00	<b>8,346</b>
5.	<b>Kasi Jackson - LA Program coordinator</b>			0.00	0.00	1.00	<b>5,721</b>
6.	( 12 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	5.00	8.00	<b>126,837</b>
7.	( 17 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	5.00	11.50	<b>154,796</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 3 ) POST DOCTORAL SCHOLARS			30.00	0.00	0.00	<b>118,821</b>
2.	( 2 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	<b>63,068</b>
3.	( 19 ) GRADUATE STUDENTS						<b>480,860</b>
4.	( 2 ) UNDERGRADUATE STUDENTS						<b>12,457</b>
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						<b>0</b>
6.	( 2 ) OTHER						<b>58,028</b>
TOTAL SALARIES AND WAGES (A + B)							<b>888,030</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>132,588</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>1,020,618</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
	<b>Autoclave</b>		\$			<b>3,334</b>	
	<b>CO2 Incubator</b>					<b>6,667</b>	
	<b>Confocal Microscope</b>					<b>133,334</b>	
	<b>Others (See Budget Comments Page...)</b>					<b>43,668</b>	
TOTAL EQUIPMENT							<b>187,003</b>
E. TRAVEL							
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							<b>40,000</b>
2. FOREIGN							<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS \$		<b>90,000</b>				
2.	TRAVEL		<b>6,138</b>				
3.	SUBSISTENCE		<b>1,980</b>				
4.	OTHER		<b>101,000</b>				
TOTAL NUMBER OF PARTICIPANTS ( 0 )							
TOTAL PARTICIPANT COSTS							<b>199,118</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>54,885</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							<b>0</b>
3. CONSULTANT SERVICES							<b>0</b>
4. COMPUTER SERVICES							<b>6,000</b>
5. SUBAWARDS							<b>0</b>
6. OTHER							<b>0</b>
TOTAL OTHER DIRECT COSTS							<b>60,885</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>1,507,624</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>total direct minus equipment &amp; participant support (Rate: 46.5000, Base: 1121503)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>521,499</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>2,029,123</b>
K. RESIDUAL FUNDS							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ <b>2,029,123</b> \$
M. COST SHARING PROPOSED LEVEL \$ <b>405,825</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Curt M Peterson</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 3

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### Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
Lederman, David - Technical PI	0.00	0.00	1.00	11458
Lewis, James - Cyber. Facility coordinator	0.00	0.00	0.50	4645
Miller, Paul - EHRDO teaching faculty	0.00	0.00	1.00	4951
Ratcliff, Betsy - EHRDO teaching faculty	0.00	0.00	1.00	6288
Rojanasakul, Yon - IRT3 Project Leader	0.00	0.00	0.50	5305
TBD, WVU New Hire - WVNano Director	0.00	4.50	0.00	57289
TBD 1, WVU EHRDO - A program -physics	0.00	0.00	1.00	6954
TBD 1, WVU Seed Proj - faculty	0.00	0.00	1.00	10609
TBD 2, WVU EHRDO - TREK	0.00	0.50	0.00	3713
TBD 3, WVU EHRDO - TREK	0.00	0.00	0.50	3713
Timperman, Aaron - IRT1 Project Leader	0.00	0.00	0.50	4250
Toth, Eva E - EHRDO researcher/evaluator	0.00	0.00	1.00	7662

### \*\* D- Equipment

Cyberinfrastructure equipment (Amount: \$ 33334)  
DU-500 General Spectrophotometer (Amount: \$ 5334)  
Laminar flow hood (Amount: \$ 5000)

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# SUMMARY PROPOSAL BUDGET

YEAR 4

ORGANIZATION <b>West Virginia University Research Corporation</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Curt M Peterson</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Curt M Peterson - PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Jeffrey Carver - TREK coordinator</b>			0.00	0.00	1.00	6,799
3.	<b>Pete Gannett - IRT2 Project Leader</b>			0.00	0.00	0.50	7,509
4.	<b>Lisa Holland - Bioresearch/Grad Program coord</b>			0.00	0.00	1.00	8,596
5.	<b>Kasi Jackson - LA Program coordinator</b>			0.00	0.00	1.00	5,893
6.	( 12 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	5.00	8.00	130,640
7.	( 17 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	5.00	11.50	159,437
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 3 ) POST DOCTORAL SCHOLARS			30.00	0.00	0.00	122,385
2.	( 2 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	44,252
3.	( 19 ) GRADUATE STUDENTS						488,625
4.	( 2 ) UNDERGRADUATE STUDENTS						11,195
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6.	( 2 ) OTHER						59,774
TOTAL SALARIES AND WAGES (A + B)							885,668
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							130,749
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							1,016,417
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
	<b>cyberinfrastructure equipment</b>					\$ 66,667	
	<b>Kinetic performance spectrometer</b>					11,670	
TOTAL EQUIPMENT							78,337
E. TRAVEL							40,000
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	105,000				
2.	TRAVEL		6,138				
3.	SUBSISTENCE		1,980				
4.	OTHER		101,000				
TOTAL NUMBER OF PARTICIPANTS ( 0 )							
TOTAL PARTICIPANT COSTS							214,118
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						51,916
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3.	CONSULTANT SERVICES						0
4.	COMPUTER SERVICES						4,000
5.	SUBAWARDS						0
6.	OTHER						0
TOTAL OTHER DIRECT COSTS							55,916
H. TOTAL DIRECT COSTS (A THROUGH G)							1,404,788
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>total direct minus equipment (Rate: 46.5000, Base: 1112333)</b>							
TOTAL INDIRECT COSTS (F&A)							517,235
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							1,922,023
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 1,922,023
M. COST SHARING PROPOSED LEVEL \$ 384,404				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Curt M Peterson</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 4

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### Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
Lederman, David - Technical PI	0.00	0.00	1.00	11801
Lewis, James - Cyber. Facility coordinator	0.00	0.00	0.50	4784
Miller, Paul - EHRDO teaching faculty	0.00	0.00	1.00	5099
Ratcliff, Betsy - EHRDO teaching faculty	0.00	0.00	1.00	6476
Rojanasakul, Yon - IRT3 Project Leader	0.00	0.00	0.50	5464
TBD, WVU New Hire - WVNano Director	0.00	4.50	0.00	59007
TBD 1, WVU EHRDO - A program -physics	0.00	0.00	1.00	7163
TBD 1, WVU Seed Proj - faculty	0.00	0.00	1.00	10927
TBD 2, WVU EHRDO - TREK	0.00	0.50	0.00	3825
TBD 3, WVU EHRDO - TREK	0.00	0.00	0.50	3825
Timperman, Aaron - IRT1 Project Leader	0.00	0.00	0.50	4377
Toth, Eva E - EHRDO researcher/evaluator	0.00	0.00	1.00	7892

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# SUMMARY PROPOSAL BUDGET

YEAR 5

ORGANIZATION <b>West Virginia University Research Corporation</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Curt M Peterson</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Curt M Peterson - PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Jeffrey Carver - TREK coordinator</b>			0.00	0.00	1.00	7,003
3.	<b>Pete Gannett - IRT2 Project Leader</b>			0.00	0.00	0.50	7,734
4.	<b>Lisa Holland - Bioresearch/Grad Program coord</b>			0.00	0.00	1.00	8,854
5.	<b>Kasi Jackson - LA Program coordinator</b>			0.00	0.00	1.00	6,070
6.	( 12 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	5.00	8.00	134,558
7.	( 17 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	5.00	11.50	164,219
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 3 ) POST DOCTORAL SCHOLARS			30.00	0.00	0.00	126,057
2.	( 2 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	23,296
3.	( 16 ) GRADUATE STUDENTS						415,624
4.	( 1 ) UNDERGRADUATE STUDENTS						9,941
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6.	( 2 ) OTHER						61,567
TOTAL SALARIES AND WAGES (A + B)							800,704
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							123,424
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							924,128
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
	<b>cyberinfrastructure equipment</b>			\$		101,016	
TOTAL EQUIPMENT							101,016
E. TRAVEL							35,500
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	105,000				
2.	TRAVEL		6,183				
3.	SUBSISTENCE		1,980				
4.	OTHER		101,000				
TOTAL NUMBER OF PARTICIPANTS ( 0 )							
TOTAL PARTICIPANT COSTS							214,163
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						42,634
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3.	CONSULTANT SERVICES						0
4.	COMPUTER SERVICES						2,000
5.	SUBAWARDS						0
6.	OTHER						0
TOTAL OTHER DIRECT COSTS							44,634
H. TOTAL DIRECT COSTS (A THROUGH G)							1,319,441
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>total direct minus equipment (Rate: 46.5000, Base: 1004260)</b>							
TOTAL INDIRECT COSTS (F&A)							466,981
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							1,786,422
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 1,786,422
M. COST SHARING PROPOSED LEVEL \$ 357,284				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Curt M Peterson</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 5

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### Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested
Lederman, David - Technical PI	0.00	0.00	1.00	12155
Lewis, James - Cyber. Facility coordinator	0.00	0.00	0.50	4928
Miller, Paul - EHRDO teaching faculty	0.00	0.00	1.00	5252
Ratcliff, Betsy - EHRDO teaching faculty	0.00	0.00	1.00	6670
Rojanasakul, Yon - IRT3 Project Leader	0.00	0.00	0.50	5628
TBD, WVU New Hire - WVNano Director	0.00	4.50	0.00	60777
TBD 1, WVU EHRDO - A program -physics	0.00	0.00	1.00	7378
TBD 1, WVU Seed Proj - faculty	0.00	0.00	1.00	11255
TBD 2, WVU EHRDO - TREK	0.00	0.50	0.00	3939
TBD 3, WVU EHRDO - TREK	0.00	0.00	0.50	3939
Timperman, Aaron - IRT1 Project Leader	0.00	0.00	0.50	4509
Toth, Eva E - EHRDO researcher/evaluator	0.00	0.00	1.00	8128

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# SUMMARY PROPOSAL BUDGET

Cumulative

ORGANIZATION <b>West Virginia University Research Corporation</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Curt M Peterson</b>				AWARD NO.	Proposed	Granted	
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		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	<b>Curt M Peterson - PI</b>			0.00	0.00	0.00	\$ 0
2.	<b>Jeffrey Carver - TREK coordinator</b>			0.00	0.00	5.00	<b>33,034</b>
3.	<b>Pete Gannett - IRT2 Project Leader</b>			0.00	0.00	2.50	<b>36,484</b>
4.	<b>Lisa Holland - Bioresearch/Grad Program coord</b>			0.00	0.00	5.00	<b>41,764</b>
5.	<b>Kasi Jackson - LA Program coordinator</b>			0.00	0.00	5.00	<b>28,632</b>
6.	( 12 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	25.00	40.00	<b>634,730</b>
7.	( 17 ) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	25.00	57.50	<b>774,644</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	( 15 ) POST DOCTORAL SCHOLARS			150.00	0.00	0.00	<b>594,623</b>
2.	( 10 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	<b>265,537</b>
3.	( 89 ) GRADUATE STUDENTS						<b>2,213,429</b>
4.	( 9 ) UNDERGRADUATE STUDENTS						<b>62,318</b>
5.	( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						<b>0</b>
6.	( 10 ) OTHER						<b>283,410</b>
TOTAL SALARIES AND WAGES (A + B)							<b>4,193,961</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>636,715</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>4,830,676</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
<b>\$ 1,002,522</b>							
TOTAL EQUIPMENT							<b>1,002,522</b>
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							<b>183,500</b>
2. FOREIGN							<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	<b>375,000</b>				
2.	TRAVEL		<b>24,597</b>				
3.	SUBSISTENCE		<b>7,920</b>				
4.	OTHER		<b>404,000</b>				
TOTAL NUMBER OF PARTICIPANTS ( 0 )							
TOTAL PARTICIPANT COSTS							<b>811,517</b>
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						<b>287,538</b>
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						<b>0</b>
3.	CONSULTANT SERVICES						<b>0</b>
4.	COMPUTER SERVICES						<b>30,000</b>
5.	SUBAWARDS						<b>0</b>
6.	OTHER						<b>0</b>
TOTAL OTHER DIRECT COSTS							<b>317,538</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>7,145,753</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							<b>2,479,247</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>9,625,000</b>
K. RESIDUAL FUNDS							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							<b>\$ 9,625,000</b>
M. COST SHARING PROPOSED LEVEL \$ <b>1,925,000</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Curt M Peterson</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

C \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

**West Virginia University**  
**Budget Justification**

**A. Senior Personnel**

Support is requested for:

1. Technical PI (Lederman, 1 month summer salary/yr): will direct the technical aspects of the project.
2. Senior Faculty/WVNano Director (4.5 academic months): will oversee global technical, educational and outreach activities and coordinate them with other WVNano activities. This senior faculty member will bring recognition and prestige necessary to obtain a Center status. The remaining salary and start-up funds will be provided by the institution.
3. Bioresearch Facility coordinator (Holland, ½ month summer salary/yr): responsible for coordinating BRF construction and instrument acquisition and installation. The coordinator will work closely with the WVNano Shared Facilities coordinator.
4. Cyberinfrastructure Facility coordinator (Lewis, ½ month summer salary/yr): responsible for cyberinfrastructure equipment installation and management.
5. Seed Project Faculty: Support for 1 month of summer salary for one seed project PI is requested (funding for a second seed project is provided by the jurisdiction).
6. Education/Outreach Personnel: Carver (1 month summer salary/yr) will be the faculty coordinator for the TREK program and Jackson (1 month summer salary/yr) will be the faculty coordinator for the LA program. Holland (1/2 month summer salary/yr) will be the faculty coordinator for the Graduate Fellowship Program. For the TREK program three 3 credit courses will be taught within the College of Human Resources and Education (CHRE). Toth (1 month summer salary/yr) will teach one of them and another curriculum and instruction (C&I) course will be taught by another CHRE instructor (TBA, \$3,500 ½ month summer salary/yr). An additional course taught in the Fall or Spring semester by Carver requires release time (TBA, \$3,500/semester). Ratcliff and Miller (1 month summer salary/yr each) are teaching faculty in Chemistry and Physics, respectively, and will assist in the preparation of LA program and its integration in the classroom. Support for an additional physics faculty member to participate in the LA project planning and curriculum (1 month summer salary/yr \$6,954) is requested.
7. IRT Project Faculty: Support for ½ month summer salary per year for one faculty IRT leader per IRT (Timperman, Gannett, Rojanasakul) is requested. Summer salary for IRT co-leaders will be provided from other external funding sources for complementary projects.

Requested funding for salaries includes a 3% increase per year.

**B. Other Personnel**

1. Postdoctoral Associates: Support for one postdoctoral researcher position for IRT1 and IRT2 and half-time support for IRT3 ( \$44,000/year/postdoc) is requested. An increase of 3%/yr is budgeted.
2. Other Professionals: Support for two technicians, one for the BRF facility and one to administer the high performance computing (cyber) facility, is requested. The BRF technician's salary will be \$50,000/yr (+ 3% increase/yr) but the cost to the NSF grant will be reduced by 20% from 100% for the first year in each year of the project with the balance provided by the West Virginia University Research Corporation (WVURC), the West Virginia Research Challenge Fund (WVRCF) and user fees in a proportion of 1:0.5:1. After the final year of the project, the facility will be maintained by 40% support from user fees, 40% from WVURC, and 20% WVRCF (this is the same breakdown for current WVNano Shared Facilities). The total amount of support requested from NSF is \$165,022 while the institutional match will be \$65,592 for WVURC/WVRCF + \$43,728 in user fees. A similar breakdown with a sliding amount of NSF support applies for the cyber facility technician, with Track II funding used for part of the technician's salary during the first two years (allocated in the Track II project for this purpose). The NSF contribution total over five years for the cyber technician is \$100,515, while

the jurisdictional match will be \$57,666 + \$38,444 in user fees. For the BRF, user fees will be assessed by a single fee per semester for unlimited use, while the cyber user fees will be assessed by computer hour usage.

3. Graduate Students: Support for a total of 8 graduate students/yr for IRT projects (3 for IRT1, 3 for IRT2, 2 for IRT3) at a cost of \$25,000/student/yr is requested. The two-year Graduate Fellowship Program will consist 6 students entering the first year and a second class of 6 students entering the second year, for a total of 6 students participating in the first and fifth years and 12 students in the intervening years. The support for these students will be \$27,000/student/yr. The two seed projects will support a total of 4 graduate students (two each) at \$22,000/student/yr. Support for 3 students involved in the TREK education project from the College of Education and Human Resources to help develop curricula, visit teachers in their classrooms during the year, and study the effectiveness of the program, is also requested at \$20,000/student/yr.
4. Undergraduate Students: Support for two students to help with the BRF and Cyber facilities during the year is requested (\$7,500/student/yr).
5. Other: Support for additional EHRDO Personnel are as follows: EHRDO Coordinator (12 months, 47 K/yr) to coordinate all educational programs (TREK, Learning Assistants, SURE, REU, Graduate Fellowship Program) and outreach programs (visits to schools, HBCUs, etc.) Beginning in Year 2, for the LA program, support is requested for a CHRE faculty (TBA) to teach/coordinate a 2 credit hour course "Intro to Science Teaching" (1 month summer support for planning, \$3,500 + 1 month academic year release time, \$3,500).

### C. Fringe Benefits

Fringe benefits at WVU are 26% for senior personnel and postdocs, 6.2% for graduate students, and 1.2% for undergraduate students.

### D. Equipment

Support for equipment for the BRF and HPC facilities is requested. Costs below are estimated at only 2/3 of the actual cost of the instrumentation; the remainder will be provided by the jurisdiction. In addition, 128 nodes will be purchased in Year 2 using a RII Track II award.

<u>Year 1:</u>	*Cyberinfrastructure equipment (128 nodes)	\$66,666
	*Mass spectrometer (liquid chromatography – ion trap)	\$266,667
	*Dynamic light scattering	\$46,667
	Inverted fluorescent microscopes (*1 + **1)	\$20,000
	*Micro/Nano fab equipment: Mask aligner, Wafer washer, Profilometer, Precision polymer mill, YAG etch + optical components, Plasma oxidizer	\$122,699
<u>Year 2:</u>	Cell Culture facilities: Autoclaves (*1 + **1), *CO2 Incubators (2), *Heat/cool shaking incubators (2), *DU 800 spectrophotometer, *DU 500 general spectrophotometer, *Digital freezer -80 °C, Laminar flow hoods (*1 + **1), *Ultracentrifuge, High perf. refrig. centrifuge and rotors (*1 + **1)	\$113,467
<u>Year 3:</u>	*Confocal fluorescence microscope	\$133,334
	*Cyberinfrastructure equipment (64 nodes)	\$33,334
	*Autoclave	\$3,334
	*CO2 Incubator	\$6,667
	**DU-500 General spectrophotometer	\$5,334
	*Laminar flow hood	\$5,000

<u>Year 4:</u>	+Cyberinfrastructure equipment (128 nodes)	\$66,665
	*Kinetic performance spectrometer	\$11,670
<u>Year 5:</u>	+Cyberinfrastructure equipment (192 nodes)	\$101,016

\* = BRF facility in College of Arts and Sciences. \*\* = BRF satellite facility in College of Engineering. + = HPC facility

### E. Travel

For the IRT and seed projects, travel funding for students, postdocs, and faculty to attend conferences and visit collaborators is requested (\$8,000/yr for IRT1 and IRT2; \$6,000/yr for IRT3; \$3,000/yr for each of the two seed projects). Students participating in the Graduate Fellowship Program will receive \$1,500/student/yr for travel. The TREK education program will be allocated \$10,600/yr for faculty and graduate students to visit teachers during the year and for graduate student and faculty travel to conferences. The LA education program will receive \$5,000/yr for school year visits to teacher classrooms.

### F. Participant Support Costs

Participant support is requested for the TREK and LA education programs. For the TREK program, the costs are: (1) stipends support for 9 teachers at \$667/week for 8 weeks (\$48,000/yr) and 9 high school students (one/teacher) at a cost of \$1,333/student/8 weeks (\$12,000/yr); (2) travel for teachers and students (\$6,138/yr); (3) subsistence support for attending three-day workshop (\$1,980); (4) other support including shared facilities fees for remote instrument access, conference rooms for 3 day workshop, teacher tuition support for a total of \$101,000/yr. For the LA program, the costs are (1) stipends for 5 Learning Assistants at \$1,500/semester for two semesters/yr, for a total of \$15,000/yr. These costs apply to years 2-5 (year 1 is used as a planning period) for both programs.

### G. Other Direct Costs

- Materials and supplies:* Support for general lab expenses and computers is requested for IRT1 (\$10,000/yr), IRT2 (\$10,000/yr), IRT3 (\$6,000/yr), and the two seed programs (\$4,000/yr/program). In addition, \$2,000/yr/student is requested for the Graduate Fellowship Program. Support for lab expenses is also requested for the BRF operation with its cost tapered over the 5 years of the project (\$54,868/5yrs, including 3% growth/yr) to reflect matching contributions from the jurisdiction for the shared facilities as detailed above (\$33,005/5 yrs from NSF, \$13,118 from WVURC and WVRFCF, \$8,745 from user fees). Support for general expenses for the cyber facility (computer cables and hardware, \$5,000/yr) is also requested (\$15,000/5 yrs from NSF, \$6,000 from WVURC and WVRFCF, \$4,000 from user fees).
- Publication Costs:* Support for publication costs for IRT1 (\$1,500/yr), IRT2 (\$1,500/yr), and IRT3 (\$1,000/yr) is requested.
- Computer Services:* Support for software site licensing to run the HPC cyber facility is requested. The cost is estimated at \$10,000/yr. Using the same sliding scale described above, the NSF contribution is \$30,000, the WVURC and WVRFCF contribution is \$12,000, and user fees contribute \$6,000.

### I. Indirect Costs

Indirect costs of 46.5% apply to all costs except participant support and equipment.

### M. Cost Sharing

A minimum of 20% of the total requested NSF funds will be provided as cost share by the institution, the West Virginia University Research Corporation and the West Virginia Research Challenge Fund (administered by the West Virginia Higher Education Policy Commission). The cost share will provide partial support for senior personnel, other personnel, equipment and computer services.



## Current and Pending Support

<b>Investigator:</b> _____ <i>I do not have any current or pending support</i> <input type="checkbox"/>
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *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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## Current and Pending Support

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Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *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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## FACILITIES, EQUIPMENT, AND OTHER RESOURCES

### WEST VIRGINIA UNIVERSITY (WVU)

#### WVNano Core Facilities

The following facilities are available for the project as part of the WVNano shared and collaborative facilities. Use of the WVNano Shared Facilities is available for a charge of \$750/trimester/user. Collaborative facilities are available through collaborations with the faculty manager; shared facilities are available to all users on campus. Time for the Shared Facilities is allocated via the FOM software. Three full time technicians are available for the maintenance of the shared facilities.

#### Multifunctional Materials Laboratory (MML)

The MML consists of four separate laboratories comprising approximately 2500 square feet of clean space and an additional 1000 sq ft of standard lab space housing materials growth and characterization facilities. Located in Hodges Hall in the Physics Department, under the direction of Lederman, the MML supports interdisciplinary collaborations with the Department of Chemistry, the School of Pharmacy, and the College of Engineering. 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 WVU 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 NRL.

#### Multifunctional Materials MBE Growth Room (Class 1000) (Collaborative)

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 number of advanced in-situ characterization techniques, including electron diffraction, x-ray dispersive analysis, and cathodoluminescence. There are also LEED, Auger and Omicron UHV scanning probe microscopes 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. This system is managed by Lederman and is collaborative by nature.

#### Electron Microscopy Room (Class 10,000) (Shared)

- Nomarski interference/contrast microscope
- Scanning electron microscopy with EDS capability retrofitted to allow e-beam lithography
- E-beam compatible resist spinner
- Dektak surface profiler

#### Optical Characterization Room (Class 10,000) (Shared)

- 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

#### Magnetic and Structural Characterization Room (Shared)

- Standard 2 $\theta$  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)

- Hall effect and temperature-dependent resistivity (with either a standard electromagnet (1T) or a Janis superconducting magnet (12T))
- SQUID (7 T) magnetometer (Quantum Design) capable of measuring in the 2 K to 800 K temperature range
- EGG vibrating sample magnetometer with 10 K – 325 K temperature capability
- Magneto-optic Kerr effect magnetometer with continuous flow cryostat (ARS) capable of 2 K – 325 K temperature capability
- Ferroelectric Tester (Radiant Technologies) with low temperature continuous flow cryostat capability for low temperature measurements (2 K – 325 K).

### **Scanning Probe Microscopy (Shared)**

- 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. An external break-out box allows for custom measurements. Located in the basement of Hodges Hall (Physics Department).

### **Biomolecular Facility (Shared)**

Located next to the scanning probe microscopy facility in Hodges Hall, this facility includes:

- Critical point dryer
- Optical microscope
- Refrigerator for biological samples

### **Integrated Device and Systems Laboratories**

The core theme binding nearly all research in this suite of labs is the exploration and application of advanced integrated device and system level technologies. Funded programs which populated and use these labs have emphasized 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) in the College of Engineering.

### **Nanosystem Engineering Shared Clean Room Facility (Shared)**

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 Lane Department have funded the renovation of 4000 sq. ft. of space in the adjacent engineering sciences building for 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. The facility has been equipped using major research instrumentation grants 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, mechanical engineering, and electrical engineering.

Primary shared lab equipment and resources include:

#### **Microlithography (Class 10)**

- Laurell Technologies 400 Series Spin Processors
- Karl Suss MA6 Aligner (320/365 nm)
- OAI Flood Exposure System

- 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)
- AnnealSys AS Rapid Thermal Annealing Furnace Dry Processing (Class 10000)
- 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
- Trion Minilock III ICP Reactive Ion Etcher (Chlorine based)
- Oxford Instruments 80+ Reactive Ion Etcher with ICP head (6" wafer max)
- March PX-250 Plasma Asher

#### **Inspection/Metrology (Class 100 and 10000)**

- Tencor Alpha-Step 200 Stylus Profiler
- Nikon Nomarski Lightfield//Darkfield microscope with digital camera

#### **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

#### **Nanosystem Engineering Shared Characterization Facility (Shared)**

This laboratory provides advanced sample characterization facilities. These include:

- Bruker AXS D8 Discovery X-ray Diffractometer
- VersaProbe 5000 x-ray photoelectron spectroscopy (XPS) system with ultraviolet photoelectron spectroscopy (UPS) from Physical Electronics.
- JEOL JSM-2700F scanning electron microscope including
  - Acoustic enclosure that contains passive vibration isolation, active electromagnetic field cancellation and temperature stability
  - NPGS E-beam lithography software
  - Oxford INCA Energy250 EDS
- JEOL JEM-2100 Transmission electron microscope (currently being installed) with Oxford INCA Energy 250 EDS
- JA Woollam White light ellipsometer
- Varian Digilab FTS 7000FTIR with UMA 600 microscope

## Nanoscale Imaging and Characterization Laboratory

### Multifunctional scanning probe microscope (SPM) (Collaborative)

This instrument is located in Nanoscale Imaging & Characterization Laboratory under the direction of Nick Wu in the College of Engineering. The multifunctional scanning probe microscope (Molecular imaging, PicoSPM ® II) possesses the following capabilities: contact and non-contact mode AFM, force measurement and force array imaging, Acoustic AC mode AFM (tapping mode AFM), Electrostatic force microscopy (EFM), Scanning Kelvin Probe microscopy, Magnetic force microscopy (MFM), Scanning tunneling microscopy (STM), current sensing AFM (Conductive AFM), Electrochemical AFM (EC-AFM), AFM-based nanolithography. The universal microscope base permits easy integration with an environmental chamber or an inverted optical microscope. This SPM can be extensively applied to measurement of materials, devices and biological matter.

### Optical and Probe Microscopy Facility (Collaborative)

This facility, under the direction of R. Lloyd Carroll, is located in Physics and provides optical and probe microscopic resources to faculty. Capabilities include:

- **Spinning Disk Confocal Microscopy** An inverted epifluorescence system with an integrated high resolution, electron multiplied CCD and image capture system will allow the for the imaging of tagged biomolecular, organic, and inorganic materials, characterization of three dimensional structures on the microscale, rapid imaging of fast processes in microfluidics, and localized spectroscopic characterization (with additions planned for the next year).
- **Force Microscopy** Force microscopy facilitates the study of self-assembled monolayers and biomolecular assemblages on surfaces. In addition, specific techniques using the force microscope allow the characterization of patterning of different materials on the nanoscale, in-situ imaging of self-assembly and nanoscale organization, force spectroscopy of single molecule-molecule interactions, and imaging of magnetic materials on the microscale.

### Computational Facilities

The major computing facility in the Lewis group is a Linux based 128-CPU cluster. These resources, financed by Lewis' start-up in 2006, currently serves as the initial core of the shared high-performance computing. Details about the nodes are:

- 24 nodes have two Intel Xeon 2.8GHz processors with 2 cores each available per node and 4GB of RAM available. These nodes are x86\_64 architecture.
- 4 nodes are "high-power" nodes and have 2 Xeon processors (8 cores) and 16 GB of RAM available per node. These nodes are x86\_64 architecture.

### West Virginia University Health Sciences Center (WVUHSC)

WVUHSC supports research in many ways, including an on-site library and support for core facilities. The Health Sciences Center Library is on the second floor of the WVUHSC and is close to investigators. WVUHSC has an extensive library collection and basic and clinical science departments each have their own library of current journals pertinent to that department's interest, many of which supplement WVUHSC library holdings.

Several well-equipped core facilities are also in place to support basic research, including a proteomics and mass spectrometry core, light and confocal microscopy facility (with microinjection capabilities), electron microscopy center, animal quarters and transgenic animal facility, computational chemistry core, pathology and histology core and a recombinant DNA core facility. Each of these facilities is housed at WVUHSC and are available on a fee basis. In addition, each of the basic science departments in the WVUHSC have

centralized common equipment rooms that are dedicated to supporting that departments research needs, such as scintillation counters, super-speed and ultra-centrifuges with a variety of rotor types, sonicators, FPLC, HPLC, mass spectrometry, airfuges and other shared equipment which can be used free of charge.

Each of the following core facilities are housed at WVUHSC and are operated on a fee basis with a designated individual to run day to day operations. These facilities have both user and service options.

#### **Proteomics and Mass spectrometry core facility:**

Micromass Maldi and Finnegan LC-MS (ion trap) mass spectrometers were purchased using an NCRR equipment grant (S10-RR16792-01) and are available to perform high throughput and sensitive analysis of proteins. The proteomics core facility has 2-D gel separation apparatuses, DIGE technology, a Typhoon scanner to measure changes in fluorescence intensity, as well as Robotics integrated with a computer that permits an investigator to scan a 2-D gel, highlight a protein spot of interest and instruct the robotic arm to precisely pick and excise the protein of interest, transferring it to an elution chamber and then to a trypsin-digestion chamber. Technicians then take the digest and introduce it to the mass spectrometer for identification based on time of flight technology. The mass spectrometer sends the sequence to the computer which matches it against known databases. A Proteomics Facility was established using the CoBRE grant. 900 ft<sup>2</sup> of lab space have been renovated for this facility which is on the second floor of the Health Sciences building at the School of Medicine. A core manager and a technician with mass spectrometry experience manage the facility.

#### **Light and Confocal Microscopy Core:**

This Image Analysis Facility is available to the WVU research community. The facility provides access to advanced biomedical imaging technology including state-of-the-art light microscopy and quantitative software applications. The goal of this facility is to assist WVU researchers in deriving quantitative data from a diverse range of image sources including electrophoresis, photomicrographs, transparencies, videotape, digital images, histological preparations and in vitro specimens. In addition, the facility assists the researcher in incorporating images and data collected for use in grant applications, publications and presentations. This facility has a Zeiss LSM 510 confocal microscope, an Optimas Image analysis system, MicroBrightfield stereo investigator and NeuroLucida, Codonics 1600 Dye sublimation printer, Fujix pictography 3000 color printer, Focus imaging ImageCorder slide maker, flatbed scanner with transparency adapter, Optronics MagnaFire microscope digital camera. The facility also has a live cell imaging system – it also has a Nikon E600 upright fluorescence microscope with a Spot R/T cooled CCD digital camera and associated computer software for image acquisition and analysis as well as a Nikon E200 inverted fluorescence microscope equipped with an ImageMaster-1700DDR digital imaging control module designed and dedicated for live cell imaging and analysis. Image capture and analysis is obtained with a Roper CoolSNAP-fx 12bit color CCD camera using the Metamorph Complete imaging software system driven by a custom built PC. This unit is outfitted with a Peltier heated stage, appropriate cubes and dichroics for FRET analysis and analysis for immunofluorescence at 4 separate emission spectra. This facility is available to users on a fee basis. A full-time technician is on staff to assist users. Also available in the cancer center is a Zeiss Axiovert fluorescent microscope with Axiovision advanced software, Peltier heated stage for time lapse and apotome, providing the equivalent of a confocal image acquisition and analysis system.

#### **Electron Microscopy Facility:**

A Health Sciences Center Core Electron Microscopy Facility provides complete scanning and transmission EM services on a fee-for-use basis. This well-equipped center is staffed full-time and supervised by faculty from the Departments of Pathology and Anatomy. Investigators can obtain

consultation regarding experimental design, as well as expert tissue preparation and ultra-thin sectioning services. One of two recently purchased microscopes is a JEOL TEM, and both instruments are covered by manufacturer service contracts. The Core EM facility also offers complete darkroom services. The HSC Image Analysis facility of the Anatomy Dept. offers a comprehensive confocal imaging system (Zeiss LSM-510) and an integrated microscopy system for neuroanatomical 3-D reconstruction and design-based stereology (NeuroLucida and Stereo Investigator; MicroBrightfield, Inc.).

#### **Animal Quarters and Transgenic Animal Facility:**

The animal quarters is on the first floor of WVUHSC and oversees the care of many different species of animals, including mice, rats, dogs, cats, reptiles and chickens. Also, the facility has two incubators for hatching eggs. WVU School of Medicine was one of 41 recipients of a Biomedical Research Support Program from the Howard Hughes Medical Institute. Some of these funds are being used to construct a transgenic rodent core facility (TRCF) at the medical center. A relatively unique aspect of the program is the ability to generate transgenic mice and rats. Rats are often the species of choice in physiological studies, and the ability to provide transgenic animals represents a powerful research tool. The objective of the TRCF is to serve as a central molecular biology resource for conception and execution of new projects and provide resources to help offset the high costs of developing transgenic animals. Construction of the facility has been completed and staff are being hired. The goal is to provide a facility that provides better quality control, turn around time, and cost effectiveness than commercially available services. TRCF staff will be available for education, assistance and consultation during all stages of transgenic animal development, and are responsible for implementing new transgenic technologies such as conditional gene deletion and temporal transgene expression.

#### **Computational Chemistry and Molecular Modeling Research Laboratory:**

The Computational Chemistry and Molecular Modeling Laboratory houses hardware and software necessary for the study of the properties of a wide range of chemical or biological interests. The Laboratory provides researchers in the chemical, biological, and pharmaceutical sciences located in West Virginia access to both local and remote access to computational facilities. The Laboratory for Computational Chemistry and Molecular Modeling has three Silicon Graphics OCTANE computers. It is networked to an SGI Origin 2000 12 processor machine, and can access computers at remote locations including the NCSA. Access to remote locations is possible over the vBNS. The Laboratory has several software packages suitable for molecular modeling including SYBYL, CoMFA, Insight2000, Charmm, and AMBER. Laboratory facilities can be used on-site or accessed remotely. Small molecules can be studied by either quantum mechanical or molecular modeling methods. For higher level calculations, the Laboratory is running Gaussian98, Q-Chem, and HyperChem. Larger molecules, especially those of biological interest, can be studied by molecular mechanics and molecular dynamics. The Computational Chemistry and Molecular Modeling Laboratory is open to anyone with a need for access to computational resources including both software and hardware that the facility maintains. Currently, the facility serves faculty and graduate students at WVU and other colleges and universities in West Virginia. The Laboratory is interested in projects that require computational resources for the study of small molecules as well as large molecules of biological interest. Current users of the laboratory have experience in modeling small molecules, DNA and proteins and can aid researchers new to the area of computational chemistry or molecular modeling. The facility can be accessed remotely so that users do not need to come to the facility, if they have internet access and appropriate communication software. Online tutorials for using the facility are available as are a collection of hyperlinks to other websites that have useful programs and information for molecular modeling.

**Pathology and Histology services:**

The Anatomic Pathology Division of the Pathology Department offers various services, including Autopsy Service, Surgical Pathology, Cytopathology and Neuropathology analysis. This group has a collection of paraffin embedded tissues that can be accessed for immunohistochemical analysis. A centralized Histology Laboratory, which provides routine processing, sectioning and staining of body tissues, as well as a wide variety of special stains and advanced immunohistochemical procedures are available on a charge basis. On-site technicians will section requested tissues and perform immunohistochemical labeling on a fee basis. Optionally, sections can be mounted on slides and the investigator may process immunohistochemical labeling. This section prepares 250,000 slides a year for pathologic examination. In the Cytopathology Laboratory, cellular morphology studies are performed on a variety of specimens, including gynecologic smears, body fluids and fine needle aspirations. The Cytopathology Laboratory examines 8,000 gynecologic specimens and 2,500 non-gynecologic specimens annually. About 300 fine needle aspirations are performed each year.

**Recombinant DNA Core Facility:**

The purpose of the WVU Recombinant DNA Core Facility (RDCF) is to provide the necessary technology and expertise to assist investigators in conducting molecular biology experiments. The RDCF operates as a non-profit core facility of WVU and the Mary Babb Randolph Cancer Center and is administered by a facility manager who is paid by the MBRCC, as well as having a facility director and an oversight committee. The WVU Recombinant DNA Core Facility maintains equipment and provide services for the benefit of the researchers at WVUHSC, including DNA array analysis, oligonucleotide synthesis, computer work-station/databank searches, X-ray processor, video tapes of techniques in molecular cloning and recombinant DNA technology, large scale isolation and purification of plasmid DNA, enzymes and purification kits, DNA Thermal Cycler, radioanalytical imaging, phosphorimaging software, apparatus and cassettes, FPLC Chromatography, Common Research Equipment, DNA Sequencing, Competent Stocks of Common E.coli Strains and training services available for common techniques. Major equipment and services are available on a fee basis. For DNA array analysis, a Virtek DNA chip reader with software is available, as are DNA chips which are purchased in lots of 125 and stored in the DNA core facility. Chips are sold to researchers for \$225/each (at cost).

**FACS/Cell Sorting:**

The MBRCC owns a Becton-Dickinson FACScan and FACStar Plus, which are housed in the MBRCC facility. The analyzer and cell sorter are housed in the Flow Cytometry core facility, on the 2<sup>nd</sup> floor of WVUHSC. The FACS is operated as a user facility and a core director operates the facility.

**Electrical Cell-Substrate Impedance Sensing: (ECIS, Applied Biophysics)**

A highly quantitative and sensitive instrument for assaying cell adhesion, cell spreading, motility and invasion.

**MARSHALL UNIVERSITY (MU)**

Marshall University, at the level of both the institution and individual investigator, has made judicious decisions regarding expenditure of funds that provide space, major equipment, and resources that guarantee that this RII investment will bear fruit. In late 2006, a new, 144,000 ft<sup>2</sup> research facility (Byrd Biotechnology Science Center; BBSC) opened that is devoted to research and teaching. This state-of-the-art facility houses many faculty from the College of Science, including five of the senior personnel of this proposal. The BBSC is physically connected to the Science Building via an enclosed walkway, providing efficient access to the remainder of the Team's labs/offices in both the College of Science and College of

Education. All faculty have ample individually-assigned laboratory and office space that support research, outreach, workforce development, and other efforts described in this application, and several common-access rooms house shared equipment. As a virtual center, the MU Cell Differentiation and Development Center has no physical boundaries but central administration (Dr. Price and an administrative associate) is located in the BBSC. In addition, BBSC and the Science Building house many items of equipment crucial to successful completion of this project. These are listed below, along with a brief description of the item's uses and applications. Equipment purchased, either in whole or part, via past RII funding is underlined. It should be noted that the equipment itemized below is a *fraction* of the total equipment possessed by Team members. Every item of equipment and instrumentation required for successful implementation of research and programs found in this application can be found in the appropriate scientist's lab.

The Science Building has shared labs for eukaryotic cell culture with sterile hood, liquid nitrogen storage, CO<sub>2</sub> incubators and dedicated media storage space. Also available are shared facilities for prokaryote culture, -80°C storage and a darkroom. The building is equipped with multiple lecture rooms and teaching labs with state-of-the art projection facilities. The entire building has wireless internet access.

Dr. Norton is director of the Molecular and Biological Imaging Center housed in the BBSC. Equipment and instruments housed there provide MU CDDC investigators the capability to image nanostructures, microstructures, cells and tissues. Diverse experiments are supported by this imaging center from the confocal microscopy to DNA-protein interactions. Equipment includes: 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); 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. Nanotechnology-specific items include: Hummer 6.2 Plasma Coater (Rotary Pump prepped for Oxygen available); SPI Brand Modular Carbon coating System with Carbon Rod and Fiber Heads; Lithography Systems (UV Exposure System, Spin Coater, Plasma Cleaner).

Dr. Price recently purchased a Zeiss Axio Observer fluorescence microscope with live-cell, time-lapse capability. This instrument has 6 cubes for different fluorophores and 4x, 10x, 40x, and 63x objectives. A PC with 4 Tb of storage is dedicated to this unit. Cell culture equipment is also available including NuAire biological safety cabinets and three Thermo Forma CO<sub>2</sub> incubators (one dedicated to hypoxic conditions for stem cell growth),

Dr. Georgel's lab houses a Beckman Analytical Ultracentrifuge which is used to accurately measure DNA-protein, RNA-protein, and protein-protein interactions.

Dr. Wang recently purchased a ABI Genetic Analyzer which is used to analyze RNA structure using SHAPE analysis.

Dr. Trzyna's laboratory houses a BioRad CHEF electrophoresis system for the electrophoretic analysis of amoeba (or other) chromosomal DNA.

Dr. Antonsen's laboratory houses rigs for the electrophysiological characterization of nerve cells.

MU also supports additional cores, with the following instruments available to team members.

#### **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 Spectrometer with Motorola Update (2 available); Varian 60 MHz w/Fourier Transform Upgrade; Gradient Shim Set.

#### **DNA and Functional Genomics Core Facility:**

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 Icyler Real time PCR; Nano Drop Spectrophotometer; Hewlett Packard Model 2100 Bioanalyzer (microchannel nucleic acid analysis); Four MJ Thermal Cyclers (conventional PCR); Mini Fluorometer. The Analytical Core Laboratory contains a BD FACS Aria, Beckman PF2D for protein separation, Luminex Multiplex analyzer, and Waters HPLC with a photo diode array detector.

#### **Proteomics Laboratory:**

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.

#### **General Equipment:**

There exist additional items that are too numerous to list. However, general-use, general purpose equipment includes RoboCycler 96 Gradient cycler (2); UV Crosslinker; Hybridization Oven; Beckman L7 Ultracentrifuge (2); Beckman Coulter Avanti J-25 centrifuge; Bacterial culture incubators (2).

### **WEST VIRGINIA STATE UNIVERSITY (WVSU)**

Since 2000, WVSU has made substantial investments in facilities and equipment for conducting research in natural sciences (biotechnology, and environmental sciences). Initial investments were made in renovations to facilities. The University is currently exploring the expansion of research facilities via construction of new facilities and renovation of existing facilities.

The Science Building (Hamblin Hall) will be the main facility in which the proposed research activities will take place. Each participating faculty member from the Biology Department will use their existing laboratories for research. These laboratories are currently equipped with glassware and basic instrumentation. Additional instrumentation for strengthening of research cores has been identified and is requested through this proposal. Existing equipment to support research in this area include: ABI 7700 Real Time PCR; ABI 3130 16 capillary sequencing/genotyping analyzer; AXON 2000 micro array scanner; Agilent Bioanalyzer for chip-based analysis of nucleic acids and proteins; Licor 4100 genotyping scanner; Odyssey IR scanner; Beckman CEQ 8000 8 capillary SNP and microsatellite analyzer; Plant ploidy analyzer; Fluorescent semi-confocal microscope; and Axio Imager Z1 epi-fluorescence Microscope (Zeiss, Germany) including associated software Metafer v4 MetaSystems Finder digital image system.

The University is planning construction of an annex to the Science building. While this annex is under construction, the University has established a long-term lease (2-year with option of renewal) at the Dow Chemistry Research Center (Building 740) for two laboratories and two offices. One laboratory (and respective office) is currently utilized as a spare laboratory for a Land-Grant research scientist. The second laboratory is currently unassigned.

**List of Senior Investigators**

<b>Name</b>	<b>Organization</b>	<b>Department/Affiliation</b>
1 Antonsen, Brian	MU	Biological Sciences
2 Blough, Eric	MU	Biological Sciences
3 Cao, Xian-An	WVU	Computer Science and Electrical Engineering
4 Carroll, Lloyd	WVU	Chemistry
5 Cartwright, Tina	MU	School of Education
6 Carver, Jeffrey	WVU	Curriculum & Instruction/Literacy Studies
7 Collins, Sean	WVSU	College of Natural Sciences and Mathematics, Biology
8 Dawson, Jeremy	WVU	Computer Science and Electrical Engineering
9 Dinu, Cerasela	WVU	Mechanical and Aerospace Engineering
10 Edwards, Boyd	WVU	Physics
11 Famouri, Parviz	WVU	Computer Science and Electrical Engineering
12 Ganikhanov, Feruz	WVU	Physics
13 Gannett, Peter	WVU	Basic Pharmaceutical Sciences
14 Hankins, Gerald	WVSU	College of Natural Sciences and Mathematics, Biology
15 Hill, Paul	HEPC	Divison of Science and Research
16 Holland, Lisa	WVU	Chemistry
17 Hornak, Lawrence	WVU	Computer Science and Electrical Engineering
18 Jackson, Kasi	WVU	Women's Studies
19 Korakakis, Dimitris	WVU	Computer Science and Electrical Engineering
20 Lederman, David	WVU	Physics
21 Lewis, James	WVU	Physics
22 Li, Bingyun	WVU	Orthopaedics
23 Liu, Yuxin	WVU	Computer Science and Electrical Engineering
24 Lukomski, Slawomir	WVU	Microbiology
25 Maher, John	MU	Marshall University Research Corporation
26 Miller, Paul	WVU	Physics
27 Norton, Michael	MU	Chemistry
28 O'Keefe, Robin	MU	Biological Sciences
29 Peterson, Curt	WVU	West Virginia University Research Corporation
30 Price, Elmer	MU	Biological Sciences
31 Ratcliff, Betsy	WVU	Chemistry
32 Rojanasakul, Yon	WVU	Basic Pharmaceutical Sciences
33 Shi, Xiaodong	WVU	Chemistry
34 Shultz, Gary	MU	Biological Sciences
35 Sooter, Letha	WVU	Biology
36 Taylor, Jan	HEPC	Divison of Science and Research
37 Timperman, Aaron	WVU	Chemistry
38 Toledo, Jose U	WVSU	Gus R. Douglass Institute, Ag & Environ Research Station
39 Toth, Eva	WVU	Curriculum & Instruction/Literacy Studies
40 Trzyna, Wendy	MU	Biological Sciences
41 Wang, Bin	MU	Chemistry
42 Wu, Nick	WVU	Mechanical and Aerospace Engineering

\*funding for 7 additional faculty in the area of Cellular & Molecular Biology will be provided as cost share. These faculty will serve as mentors to the junior faculty. MU = 3; WVSU = 4

List of Institutions Involved in Project:

1. West Virginia Higher Education Policy Commission
2. West Virginia University
3. Marshall University
4. West Virginia State University

Other:

Center for Identification Technology Research (CITeR) at WVU

National Institute of Occupational Health and Safety (NIOSH) (Morgantown, WV)

National Institutes of Standards and Technology (NIST) (Gaithersburg, MD)

NSF Center for Environmental Implications of Nanotechnology (CEINT), Carnegie Mellon University (Pittsburgh, PA)

Mary Babb Randolph Cancer Center (MBRCC, WVU)

Protea Biosciences (Morgantown, WV)

**B.1. WVU**

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	5 Year Total	%
<b>West Virginia University -Research Focus Area 1</b>							
<i>Research</i>							
Faculty	124,726	128,468	132,322	136,292	140,381	662,189	7%
Post Docs	141,120	145,354	149,714	154,206	158,832	749,226	8%
Grad Students	259,128	266,902	274,909	283,156	291,651	1,375,746	14%
Undergraduates	15,180	13,890	12,606	11,330	10,061	63,067	1%
Other	169,868	172,235	145,351	116,674	84,987	689,115	7%
<i>Equipment</i>	<b>522,699</b>	<b>113,467</b>	<b>187,003</b>	<b>78,337</b>	<b>101,016</b>	<b>1,002,522</b>	<b>10%</b>
<i>EHR</i>							
Faculty	59,117	69,975	72,074	74,237	76,464	351,867	4%
Post Docs	0	0	0	0	0	0	0%
Grad Students	117,882	235,764	235,764	235,764	149,742	974,916	10%
Undergraduates						0	0%
Other	78,102	280,023	297,880	314,793	306,308	1,277,106	13%
<i>Outreach/Communication</i>							
<i>Indirects</i>	<b>448,783</b>	<b>524,749</b>	<b>521,500</b>	<b>517,235</b>	<b>466,981</b>	<b>2,479,248</b>	<b>26%</b>
<i>Other</i>						0	0%
<b>Total</b>	<b>\$1,936,605</b>	<b>\$1,950,827</b>	<b>\$2,029,123</b>	<b>\$1,922,024</b>	<b>\$1,786,423</b>	<b>\$9,625,002</b>	<b>100%</b>

**B.2. MU**

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	5 Year Total	%
<b>Marshall University -Research Focus Area 1</b>							
<i>Research</i>							
Faculty	36,171	105,237	140,400	140,400	140,400	562,608	10%
Post Docs		57,094	57,094	57,093	114,188	285,469	5%
Grad Students	103,344	103,344	103,344	103,344	103,344	516,720	9%
Undergraduates						0	0%
Other	161,986	295,600	315,600	320,600	323,680	1,417,466	25%
<i>Equipment</i>	<b>424,900</b>					<b>424,900</b>	<b>8%</b>
<i>EHR</i>							
Faculty	6,921	6,921				13,842	0%
Post Docs						0	0%
Grad Students	11,842	11,842	11,841	11,841	11,841	59,207	1%
Undergraduates						0	0%
Other	51,588	51,588	51,588	51,588	51,588	257,940	5%
<i>Outreach/Communication</i>	<b>119,060</b>	<b>160,860</b>	<b>139,060</b>	<b>139,060</b>	<b>139,060</b>	<b>697,100</b>	<b>12%</b>
<i>Indirects</i>	<b>172,583</b>	<b>281,688</b>	<b>301,950</b>	<b>304,050</b>	<b>329,323</b>	<b>1,389,594</b>	<b>25%</b>
<i>Other</i>						0	0%
<b>Total</b>	<b>\$1,088,395</b>	<b>\$1,074,174</b>	<b>\$1,120,877</b>	<b>\$1,127,976</b>	<b>\$1,213,424</b>	<b>\$5,624,846</b>	<b>100%</b>

**B.3. WVSU**

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	5 Year Total	%
<b>West Virginia State University -Research Focus Area 1</b>							
<i>Research</i>							
Faculty	15,327	106,226	109,413	112,696	116,077	459,739	19%
Post Docs	0	0	0	0	0	0	0%
Grad Students	34,500	34,500	34,500	34,500	0	138,000	6%
Undergraduates	27,600	27,600	27,600	27,600	27,600	138,000	6%
Other	95,360	88,612	76,703	69,586	87,854	418,115	17%
<i>Equipment</i>	220,157	0	0	0	29843	250,000	10%
<i>EHR</i>							
Faculty	7,633	7,893	8,130	8,374	8,625	40,655	2%
Post Docs						0	0%
Grad Students						0	0%
Undergraduates						0	0%
Other	36,300	37,389	38,511	39,666	40,856	192,722	8%
<i>Outreach/Communication</i>	0	76,703	76,703	76,703	76,703	306,812	13%
<i>Indirects</i>	63,122.80	111,077	113,440	115,875	100,442	503,957	21%
<i>Other</i>						0	0%
<b>Total</b>	<b>\$500,000</b>	<b>\$490,000</b>	<b>\$485,000</b>	<b>\$485,000</b>	<b>\$488,000</b>	<b>\$2,448,000</b>	<b>100%</b>

**B.4. WV HEPC**

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	5 Year Total	%
<b>West Virginia Higher Education Policy Commission -Research Focus Area 1</b>							
<i>Research</i>							
Faculty						0	
Post Docs						0	
Grad Students						0	
Undergraduates						0	
Other						0	
<i>Equipment</i>						0	
<i>EHR</i>							
Faculty						0	
Post Docs	55,322	56,982	58,691	58,691	58,691	288,377	16%
Grad Students						0	
Undergraduates						0	
Other						0	
<i>Outreach/Communication</i>	36,200	36,924	36,924	36,924	36,924	183,896	10%
<i>Indirects</i>	53,390	54,915	55,678	55,678	55,244	274,905	15%
<i>Other</i>						0	
Administration	128,339	132,894	135,422	135,422	135,255	667,332	37%
Evaluation	76,750	78,285	78,285	78,285	76,040	387,645	22%
<b>Total</b>	<b>\$350,001</b>	<b>\$360,000</b>	<b>\$365,000</b>	<b>\$365,000</b>	<b>\$362,154</b>	<b>\$1,802,155</b>	<b>100%</b>

## List of conflicts

Collaborator	Institution	RII Participants/Senior Personnel
Ruedi Aebersold	Institute for Systems Biology	A. Timperman
Amalfitano, Andrea	Duke University Medical Center	G. Hankins
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Apon, A.	University of Arkansas	P. Hill
J. Appleby	Texas A & M University	N. Wu
E. Arenholz	ALS	D. Lederman
S. Armentrout	Parabon	M.Norton
S. B. Asokan	University of North Carolina-Chapel P. Hill	L. Carroll
Atlas, Ron	University of Louisville	P. Hill
N. Azad	Hampton University	Y. Rojanasakul
Y. Bai	Jilin University, China	J. Lewis
S. Barke	University of Virginia	M. Norton
A. J. Barnes	University of North Carolina-Chapel P. Hill	L. Carroll
Deborah Baro	Georgia State University	B. Antonsen
P. Bartlett	University of California-Berkeley	M. Shi
C. Batt	Cornell University	P. Hill, J. Taylor, Y. Liu
Saeid Belkasim	Georgia State University	B. Antonsen
Tom Berlin	ABC	T. Cartwright
Stewart H. Berlocher	University of Illinois at Urbana-Champaign	S. Collins
C. Blomberg	Louisiana Tech University	W. Trzyna
Boerio-Goates, J.	Brigham Young University	P. Hill, J. Taylor
J. Borchers	NIST	D. Lederman
Bourne, David T	University of Virginia	G. Hankins
D. Bowles	University of Missouri	E. Price
Edward Boyle	National Energy Technology Laboratory (DOE)	P. Famouri
S. Brem	Arizona State University	E. Toth
B. Brodsky	University of Medicine and Dentistry of New Jersey	S. Lukomski
Morna Brothers	Harold Washington College	J. Carver
E. Brown	UC-Santa Barbara	M. Norton
S. Brueck	Univ. of New Mexico	M. Norton
Brunel, L.-C.	National High Field Magnet Laboratory	P. Gannett
G. Bryant	Nat'l Inst. Science & Tech.	J. Lewis
Buckley, G.	Roosevelt University	F. O'Keefe
Budil, D.	Northeastern University	P. Gannett
J. M. Bujnicki	Int'l Institute of Molecular and Cell Biology, Poland	S. Lukomski
Mao Cai	HRL Laboratories	B. Edwards
Carrano, M.	Smithsonian Institution	F. O'Keefe
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C. Del Castillo	Johns Hopkins University	A. Timperman
V. Castranova	NIOSH	Y. Rojanasakul, N. Wu
Jim Cathey	University of Kentucky	P. Famouri



Vivian Chabalengula	Southern Illinois University	J. Carver
T. E. Cheatham, III	University of Utah	J. Lewis
K. Chen	University of Pittsburgh	D. Korakakis
L. Chen	Private Co., Washington, DC	C. Peterson
R. E. Cheney	University of North Carolina-Chapel P. Hill	L. Carroll
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Chiorini, John A	NIH	G. Hankins
N.-S. Chong	Middle Tenn. St. Univ.	M. Norton
Douglas B. Chrisey	Rensselaer Polytechnic Institute	C. Dinu
Catharine Clark	University of Missouri	E. Price
C. R. Clauer	Virginia Tech	M. Miller
Paula Coble	University of South Florida	A. Timperman
W. Colgan	ADInstruments	W. Trzyna
N. J. Cooper	Harvard	J. Maher
E. J. Corey	Harvard	J. Maher
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T. Cui	University of Minnesota	Y. Liu
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Damiani, R.	Staatliches Museum Für Naturkunde, Germany	F, O'Keefe
Daugherty, Patrick	University of California	L. Sooter
R. Davis	Brigham Young Univ.	J. Lewis
J. Davis	University of Maryland-College Park	M. Shi
Brian Scott Day	Virginia Tech	M. Norton
Fred Dickey	Sandia National Labs	L. Hornak
Tammy Haut Donahue	Michigan Technological University	E. Blough
J. Dong	Auburn University	J. Lewis
Jonathan Dordick	Rensselaer Polytechnic Institute	C. Dinu
Thomas Dowd	Harold Washington College	J. Carver
David Drabold	Oklahoma State University	J. Jackson
D. Drabold	Ohio University	J. Lewis
John W. Drake	National Institute of Environmental Health Sciences	G. Schultz
V. Dravid	Northwestern University	N. Wu
Hugh W. Ducklow	Marine Biological Laboratory	G. Schultz
C. Dwyer	Duke Univ.	M. Norton
Ava Dykes	University of Hawaii	M. Norton
Kate Edler	Illinois State University	J. Carver
Donald Edwards	Georgia State University	B. Antonsen
Edwards, W. F	Utah State University	B. Edwards
B. Edwards	Univ. of Tennessee	J. Lewis
Bob Efiler	Michigan Technical University	E. Blough
G. Ehrlich	Allegheny Singer Research Institute	E. Toth
Andrew D. Ellington	University of Texas-Austin	L. Sooter
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Amanda Ensminger	University of Kentucky	J. Jackson
G. Erdos	University of Pittsburgh	E. Toth
C.Evans	Wellman Photomedicine, Harvard Medical School	F. Ganikhanov

J. Falk	University of Pittsburgh	D. Korakakis
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Joel Faulk	Univ. of Pittsburgh	L. Hornak
Ke Feng	WV Wesleyan College	L. Hornak
Gregory Ferrence	Illinois State University	J. Carver
A. L. Fetter	Stanford University	B. Edwards
Kimberly Fisher	Rhodes College	J. Carver
M. Fitzsimmons	Los Alamos	D. Lederman
F. Flores	Univ. Autonoma de Madrid	J. Lewis
B. E. Forman	Lincoln Laboratories	T. Cartwright
George E. Fox	University of Houston	G. Schultz
J. Fucelli	University of Utah	J. Lewis
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Linda Fuselier	MSU-Morehead	J. Jackson
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Michael Goodman	WV High Tech Consortium	J. Dawson
C.B. Gorman	North Carolina State University	L. Carroll
Graham, J.	Scripps Oceanographic Institute	J. Taylor, P. Hill
M. Gray	NETL	B. Li
Greenbaum, N. L.	Florida State University	P. Gannett
Elizabeth Gregory	University of Kentucky	J. Jackson
D. Gullberg	University of Bergen, Norway	S. Lukomski
M.F. Gyure	HRL Laboratories	B. Edwards
Chuck Haines	Haskell Indian Nations University	L. Holland
R. G. Hallowell	Lincoln Laboratories	T. Cartwright
Yvonne Harris	William Rainy Harper College	J. Carver
Mary Ann Harrison	WV High Tech Consortium	J. Dawson
S. J. Hart	Naval Research Laboratory	S. Lukomski
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D. T. Haynie	South Florida University	B. Li
Head, J.	University of Toronto at Mississauga, Canada	F. O'Keefe
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Jan Hermans	University of North Carolina	J. Lewis
H. Herwald	Lund University, Sweden	S. Lukomski
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P. Hiller	Canterbury Museum, New Zealand	F. O'Keefe

A. Hoffmann	Argonne National Laboratory	D. Lederman
A. Holian	University of Montana	N. Wu
U. H. Hömmerich	Hampton University	N. Wu
P. Hong	GE Research Center	A. Cao
G. Hoogenboom	University of Georgia	C. Peterson
M. Höök	IBT/TAMU HSC	S. Lukomski
Hopson, J. A.	University of Chicago	F. O'Keefe
X.Y. Hou	Fudan University, China	A. Cao
Roger House	William Rainy Harper College	J. Carver
Jonathan Howard	Max Planck Inst. Molecular Cell Biology and Genetics	C. Dinu
Huang, J	Michigan State University	B. Edwards
C. Huang	New York University	Y. Rojanasakul
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Jirtle, Randy L.	Duke University Medical Center	G. Hankins
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B. F. Jones	University of North Carolina-Chapel P. Hill	L. Carroll
Jim Jorgenson	University of North Carolina-Chapel P. Hill	L. Holland
Karimi, Kambiz	Ingenuity Systems	G. Hankins
M. Kasahara	University of Kyoto	D. Korakakis
D. Keffer	Univ. of Tennessee	J. Lewis
J. B. Keith	CalTech	J. Lewis
Kerslick, G.	Cornell University	P. Hill, J. Taylor
A. R. Kerstein	Sandia National Laboratories	B. Edwards
Khonsari, M.	Louisiana State University	P. Hill, J. Taylor
O. Khorgulkuu	NETL	J. Lewis
D. Klahr	Carnegie Mellon University	E. Toth
Sirintorn Klinsukont	NIH	M. Norton
T. N. Krishnamurti	Florida State University	T. Cartwright
A. Kuang	Pan American University	C. Peterson
H. Kung	Northwestern University	N. Wu
Eugenia Kuo	Institute for Nuclear Geophysics	B. Edwards
Mosbah M. Kushad	University of Illinois, Champaign-Urbana (UIUC)	J. U. Toledo
LaBarbera, M.	University of Chicago	F. O'Keefe
R. Lacey	Louisiana Tech University	W. Trzyna
R. Lake	Univ. of CA-Riverside	J. Lewis
B. Lalevic	Rutgers University	L. Hornak
Larsson, H. C. E.	McGill University, Canada	F. O'Keefe
R. Larty	USDA	C. Peterson
H. Laughlin	University of Missouri	E. Price
Lawson, T.	Eppley Cancer Research Inst., UNMC	P. Gannett
S. F. Leboeuf	Valencell, Inc.	A. Cao

A. J. Leffler	University of Utah	W. Trzyna
F. Legare	INRS-EMT, Varennes, Canada	F. Ganikhanov
X. Legras	Louisiana Tech University	W. Trzyna
James A. Levin	University of Illinois, Champaign-Urbana (UIUC)	E. Toth
Randolph V. Lewis	University of Wyoming	W. Trzyna
C. Li	Dalian Inst. of Chemical Physics, China	J. Lewis
Y. Y. Li	Chinese Academy of Sciences, China	B. Li
Huaqing Li	University of Tennessee	N. Wu
Li, Hongwei	University of Florida	G. Hankins
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Little, T. S.	University of South Carolina	P. Hill, J. Taylor
Joseph Littley	Michigan State University	B. Edwards
ZhiZhang Li—Zhejiang	University of China	N. Wu
Donald Lloyd	LAI, Westmin., MD	L. Hornak
L. Ludovico	Duquesne University	E. Toth
Susan Lunte	University of Kansas	L. Holland
Hao Luo	University of Wisconsin	B. Edwards
Maga, A.	Institut de Recherches en Sciences Humaines, Niger	F. O'Keefe
Xiuli Mao	Virginia Tech	A. Timperman
Scott Mao	University of Pittsburgh	N. Wu
R. T. Marconi	Medical College of VA Commonwealth University	S. Lukomski
John B. Masiunas	University of Illinois, Champaign-Urbana (UIUC)	J. U. Toledo
Massare, J.	SUNY Brockport	F. O'Keefe
R. McAllister	University of Missouri	E. Price
R. M. McCown	Duquesne University	E. Toth
K. M. McHugh	The Ohio State University	W. Trzyna
Nicolas McKletchie	University of Kentucky	J. Jackson
McMasters, Sun	Dugway Proving Ground	L. Sooter
Chris Meadows	Purdue University	M. Norton
Karen Mesce	University of Minnesota	B. Antonsen
William J. Mitsch	Ohio State University	J. Taylor
M. P. Moore	Lincoln Laboratories	T. Cartwright
Angela Morrow	Independent	C. Peterson
B. Morrow	Duquesne University	E. Toth
A. Mount	Clemson University	L. Carroll
T. D. Moustakas	Boston University	D. Korakakis
Frackson Mumba	Southern Illinois University	J. Carver
J. M. Musser	Baylor College of Medicine	S. Lukomski
Thomas Myers	Texas State University	J. Dawson, L. Hornak, D. Lederman
Kazumitsu Nakashima	Baylor College of Medicine	S. Lukomski
Stephen F. Nelsen	University of Wisconsin	P. Gannett
Fred Nesbitt	Coppin State University	L. Holland
D. Nicholson	Oak Ridge Nat'l Lab.	J. Lewis
Staffan Nilsson	University of Lund	L. Holland

H. Ohldag	SSRL	D. Lederman
Richard D. Oleschuk	Queen's University at Kingston, Ontario, Canada	B. Wang
J. Ortega	Univ. Autonoma de Madrid	J. Lewis
Tom Owens	WV High Tech Consortium	J. Dawson
E. D. Paramo	Instituto Politecnico Nacional (IPN), México	J. U. Toledo
H. Patel	Louisiana Tech University	W. Trzyna
Dorothy Paul	University of Victoria	B. Antonsen
S. J. Pearton	University of Florida	A. Cao
Louis Pecora	Naval Research Laboratories	J. Dawson
Pellegrino, Paul M.	United States Army Research Laboratory	L. Sooter
Stephanie Persson	Illinois State University	J. Carver
P. Martin Petkovich	Queen's University at Kingston, Ontario, Canada	B. Wang
C. P. Pfeffer	Harvard Medical School	F. Ganikhanov
Pittman, Debra D	Genetics Institute	G. Hankins
D. Porter	NIOSH	N. Wu
C. Post	Allegheny Singer Research Institute	E. Toth
E. O. Potma	University of California-Irvine	F. Ganikhanov
R. Prather	University of Missouri	E. Price
Price, D.	University of Hawaii	P. Hill
S. Pritchard	College of Charleston, SC	C. Peterson
Robert Putt	Michigan Technical University	E. Blough
Eric Pyle	James Madison University	L. Holland
Y. Qian	NIOSH	B. Li
K. M. K. Rao	NIOSH	B. Li
Chris Rathbone	University of Arizona	E. Price
Peter S. Ray	Florida State University	T. Cartwright
S. D. Reid	Wake Forest University	S. Lukomski
Peter Reiser	Ohio State University	E. Blough
Tom Repine	WV Geological Survey	T. Cartwright
Alan Rezek	National Weather Service	T. Cartwright
Dent Rhodes	Illinois State University	J. Carver
Rieppel, O.	Field Museum of Natural History	F. O'Keefe
Steven Rissing	Ohio State University	Collins
Gene E. Robinson	University of Illinois at Urbana-Champaign	Collins
J. Robinson	University of Wisconsin-Madison	Y. Rojanasakul
A. Rogerson	California State Univ.-Fresno	W. Trzyna
L. J. Rong	Chinese Academy of Sciences, China	B. Li
L. Rowland	Aymont Technology	A. Cao
R. Ruoff	Northwestern University	N. Wu
James Rush	University of Guelph	E. Price
Salamo, G.	University of Arkansas	P. Hill, J. Taylor
Otto F. Sankey	Arizona State University	J. Lewis
Peter H. Santschi	Texas A&M University-Galveston	Schultz
R. Craig Sargent	University of Kentucky	J. Jackson
Sato, T.	National Science Museum, Tokyo	F. O'Keefe
Saulle, Dwight	University of Virginia	G. Hankins
Robert Schwartz	Naval Weapons Center	M. Norton
I. K. Schuller	University of California-San Diego	D. Lederman

N. Seeman	New York Univ.	M. Norton
J. Seminario	Texas A&M	M. Norton
Sereno, P. C.	University of Chicago	F. O'Keefe
Rosana Shafer	West Virginia University	L. Holland
Shaughnessy, K. H.	University of Alabama	P. Gannett
R. Shelby	USDA	C. Peterson
Wanqiu Shen	New York Univ.	M. Norton
Shi, X.	NIOSH	P. Gannett
X. Shi	University of Kentucky	Y. Rojanasakul
Sidor, C. A.	University of Washington	F. O'Keefe
Charles Sih	University of Wisconsin	P. Gannett
K. Sikorski	University of Utah	J. Lewis
Simon, James E.	Rutgers University	G. Hankins
A. Sirkin	TDI, Inc	A. Cao
Smith, D. H.	National Energy Technology Laboratory (DOE)	B. Edwards
Smith, R. M. H.	South African Museum, South Africa	F. O'Keefe
Soh, H. Tom	University of California, Santa Barbara	L. Sooter
Solounias, N.	New York College of Osteopathic Medicine	F. O'Keefe
Spangler, R. S.	Bethany College	B. Edwards
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Stagliano, Nancy	Cynvenio Biosystems	L. Sooter
C. Stehlik	Northwestern University	Y. Rojanasakul
Steyer, J. S.	CNRS-MNHN, France	F. O'Keefe
J. Stickney	University of Georgia	M. Norton
J. Stohr	SSRL	D. Lederman
H. Stokes	Brigham Young Univ.	J. Lewis
Stratis-Cullum, Dimitra N.	United States Army Research Laboratory	L. Sooter
M. Su	University of Central Florida	N. Wu
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R. Superfine	University of North Carolina-Chapel	L. Carroll
M. Swanson	University of Nebraska	W. Trzyna
Jonathan Sweedler	University of Illinois	A. Timperman
J. Switzer	Univ. of Missouri-Rolla	M. Norton
D. Tafen	NETL	J. Lewis
Hideyo Takatsuki	Gunman University	E. Blough
C. L. Tang	Cornell University	F. Ganikhanov
S. Te-Velthuis	Argonne National Laboratory	D. Lederman
Stuart Tewksbury	Stevens Inst. of Tech.	L. Hornak
K. E. Theriault	Lincoln Laboratories	T. Cartwright
Cathy Toll	Toll and Associates	J. Carver
F. D. Toste	University of California-Berkeley	M. Shi
Toth, B.	Eppley Cancer Research Inst., UNMC	P. Gannett
Tracy, T. S.	Univ. of Minnesota	P. Gannett
T. N. Truong	University of Utah	J. Lewis
Tseng, R.	University of Hawaii	P. Hill

A. Varma	University of Notre Dame	B. Li
Vasquez, D. A.	Indiana Univ.-Purdue	B. Edwards
M. Vavarek	Glennville State College	W. Trzyna
Robert Von Dreele	LAN/Argonne	M. Norton
Gregory A. Voth	University of Utah	J. Lewis
Y. Voziyanov	Louisiana Tech University	W. Trzyna
C. P. Wagner	SAHM	T. Cartwright
Wagner, P. J.	Smithsonian Institution	F. O'Keefe
L. Wang	NIOSH	Y. Rojanasakul
Q. Wang	University of South Carolina	M. Shi
C. Wang	University of Maryland	N. Wu
S. Washburn	University of North Carolina-Chapel	L. Carroll
Michael Waugh	University of Illinois, Champaign-Urbana (UIUC)	E. Toth
Michael Webb	Lockheed Martin	J. Dawson
Webb, Donna J.	Vanderbilt University	G. Hankins
Kevin M. Weeks	University of North Carolina-Chapel	B. Wang
R. D. Wells	IBT/TAMU HSC	S. Lukomski
John West	Kent State University	L. Holland
J. Wikswo	Vanderbilt University	Liu
Erin Wilson	Southern Illinois University	J. Carver
K. Dane Wittrup	Massachusetts Institute of Technology	L. Sooter
M. M. Wolfson	Lincoln Laboratories	T. Cartwright
R. B. Woodford	Harvard	Maher
Christopher Woodman	Texas A & M University	E. Price
S. Woodruff	National Energy Technology Laboratory (DOE)	L. Hornak
S. Woodruff	NETL, DoE	D. Korakakis
Wright, Theodore R.F	University of Virginia	G. Hankins
Miaozong Wu	Virginia Technical University	E. Blough
S.-X. Xie	Harvard University	F. Ganikhanov
C. H. Yan	Invenlux Corp.	A. Cao
Weitao Yang	Duke University	J. Lewis
J. P. Zhang	Sensor Electronic Technology	A. Cao
Zhang, Yanting	Cynvenio Biosystems	L. Sooter
Hong Zhong	New York Univ.	M. Norton
P. Zipfel	Friedrich-ScP. Hiller University, Jena, Germany	S. Lukomski

October 09, 2009

**Dr. Henry N, Blount**  
Office Head,  
The National Science Foundation  
Office of EPSCoR  
4201 Wilson Boulevard  
Arlington, VA 22230

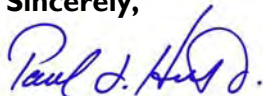
Dear Dr. Blount,

The West Virginia Higher Education Policy Commission is pleased to provide this letter of support for the current RII EPSCoR proposal to the National Science Foundation. The proposal, “Nanotechnology and Biotechnology for Environmental Safety and Public Security,” will enhance the research infrastructure at West Virginia University, Marshall University and West Virginia State University as well as other institutions across the state system of postsecondary education. The new faculty hires, new equipment, facilities and opportunities for students will build strong new competitiveness within our system and strategically link people and tools aligned with our state Vision 2015 Plan.

As a contributing partner, we will commit funds from the West Virginia Research Challenge Fund toward the required cost share. Specifically, RCF funds totaling \$2,230,200 will be provided to ensure expanded infrastructure development at West Virginia University (\$962,500), Marshall University (\$562,500), WV SU (\$244,800) and PUIs –community colleges (\$100,000). To complete this cost share, our administrative office for WVEPSCoR will receive \$360,400 to support management, oversight, evaluation and reporting functions.

Support of the NSF through the EPSCoR program has had a profound effect on academic research in West Virginia. The dramatic increases in competitive sponsored research provides clear evidence that the infrastructure provided by EPSCoR is driving increased grant writing, educational opportunities and emergence of new research programs. The partnership between NSF and WV is recognized at the highest levels of state government and we are committed to supporting these efforts well beyond the proposed grant period.

Sincerely,



**Paul L. Hill, Ph. D.**  
Vice Chancellor for Science and Research  
WVEPSCoR Project Director



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October 9, 2009

Henry N. Blount, Ph.D.  
Office Head  
Office of Experimental Program to Stimulate Competitive Research  
1122S  
The National Science Foundation  
4201 Wilson Boulevard  
Arlington, Virginia 2223

Dear Dr. Blount:

It is with great enthusiasm that we write this letter of support for the West Virginia proposal, **“Research Infrastructure Improvement: Nanotechnology and Biotechnology for Environmental Safety and Public Security”** submitted in response to the Track 1, EPSCoR Research Infrastructure Improvement Program. The infrastructure request will advance scientific research in detecting the presence of threat agents using nanotechnology. To implement these advances statewide, West Virginia proposes to bring a new suite of biomolecular engineering instrumentation, new computing capabilities, and new faculty expertise to the state. Synergistic with this, the WVU activities support STEM education. WVU is committed to these improvements and to providing substantial financial and administrative support for the proposed improvements.

The WVU Research Corporation (WVURC) and the WV Higher Education Policy Commission (HEPC) will provide \$1,925,000 as cost share to augment the activities described in the proposal. WVURC is committing \$1,000,000, and HEPC (via the WV Research Challenge Fund) is contributing \$925,000 to the total cost share. As described in the budget justification, this cost share will support equipment, personnel, graduate student fellowships, partial support for a senior faculty member/Director, and the Seed Program. Specifically, cost share from WVURC will pay for equipment in the Bioengineering Research Facility (BRF) and the High Performance Computing (HPC) cluster in the Cyberinfrastructure Facility. Consistent with the teaching training and learning mission, WVU will waive the tuition for any graduate student receiving a research stipend through activities supported by this NSF-RII proposal.

WVU will also cover 40% (30% Colleges, 70% Research Corporation) of the operating costs for the existing shared facilities and for the proposed BRF and the HPC facility in sliding scale as described in the Budget Justification.

Under the 2006 RII award there was an expectation to hire ten new faculty members, five of whom were to be women and minorities to broaden participation in the faculty workforce as defined by NSF. This goal has been met - all faculty have been hired with the last hire expected to join the faculty in January 2010. These are permanent tenure-track positions that will be supported beyond the close of the current RII award.

As described in the proposal, a dual-career hiring program is important to increase institutional diversity. To complement the University's commitment to provide and sustain positions for spousal hires, the state EPSCoR office, under the leadership of Dr. Paul Hill, WVEPSCoR Director, has agreed to provide the funding to support the spousal hire positions for the first two years of their appointment before the positions are then supported by the Provost's office.

Thank you for the effort you devote to supporting EPSCoR programs. We will be pleased to provide any additional information or clarification regarding our commitments to this RII proposal.

Sincerely,

A handwritten signature in cursive script that reads "Curt M. Peterson". The signature is written in black ink and is positioned above the typed name.

Curt M. Peterson  
Vice President for Research and Economic Development  
and President, WVU Research Corporation

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Office of the President

October 8, 2009

Dr. Henry Blount  
Head, NSF EPSCoR Program  
The National Science Foundation  
4201 Wilson Blvd.  
Arlington, VA 22230

Dear Dr. Blount:

I enthusiastically affirm Marshall University's resource commitments as part of WVEPSCoR's 2009 RII proposal. Marshall has continued to make the progress called for in our research strategy by advancing multidisciplinary research between the School of Medicine, the College of Science and the Marshall Institute for Interdisciplinary Research (MIIR). Three years ago, a new basic research facility was dedicated and opened. It provides over 75,000 net square feet of state-of-the-art research, laboratory and academic space supporting grant-funded researchers in these three units.

Marshall's research enterprise is being developed in the School of Medicine (SOM), through a \$9.3 MM COBRE award, in the College of Science (COS) through NSF's RII program, and in SOM, COS and MIIR through the state's Eminent Scholars Research Enhancement and the West Virginia Research Trust Fund. In this proposal we are requesting \$5.625 MM over five years. Marshall has committed \$1.125 MM in match, with \$562,500 in cash from Marshall and an additional \$562,500 in cash from the state's Research Challenge Fund.

With the junior faculty members from the College of Science involved in this proposal, we believe we can leverage the proposed EPSCoR funding to provide the senior mentorship and research environment conducive to bringing these individuals to a competitive level. Dr. Elmer Price, the Director of the Cellular Development and Differentiation Center and the Marshall co-PI for this application will lead this effort and interface with Dr. Eric Kmiec and the scientists of MIIR. Additional senior mentorship will be provided by research active faculty members who have progressed under the previous RII. We will hire eight teaching assistants to provide the reassigned time that developing faculty members will require for their research to progress, while also providing tuition stipends for doctoral students to bring bright minds and eager hands to the effort.

Marshall can attribute a major portion of the progress in its research enterprise to infrastructure grants like the RII. I am committed to this proposal and the long term growth of Marshall's research capability.

Sincerely,

Stephen J. Kopp, Ph.D.  
President

**WE ARE... MARSHALL™**



# WEST VIRGINIA STATE UNIVERSITY

Office of the President  
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Institute, West Virginia 25112  
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Henry N. Blount, Ph.D.  
Office Head,  
The National Science Foundation  
Office of EPSCoR  
4201 Wilson Boulevard  
Arlington, VA 22230

Dear Dr. Blount,

I am writing this letter on behalf of West Virginia State University in support of this proposal as well as a testimony of our institutional commitment to this statewide initiative. It is indeed a pleasure for me to know that our University is an active participant (along with the other two state's more prominent research institutions) in both the research and educational components embedded in this program. The possible resources this program can bring to our University will provide our faculty, students and staff with added academic benefits in the STEM related areas.

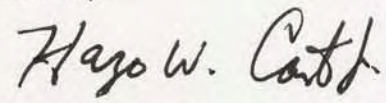
To that fact and in an effort to ensure the success of this program, the University is committing resources in the form of staff time and access to existing research space and instrumentation at the University (\$244,800 or approximately 10% of the requested award) for the effective implementation of the research and educational programs during the duration of this grant.

Furthermore, thanks to the continued support of the State (West Virginia Higher Education Policy Commission), the University will also be able to access additional resources (\$244,800) which will further supplement those possible resources committed from NSF and the University. State resources will be used to ensure that all faculty members participating in this endeavor are engaged with research and educational activities during the summer, including a Summer Undergraduate Research and educational activities for our youth.

As a Historically Black and 1890 Land-Grant University, West Virginia State University strives to address the research needs of our state's stakeholders as well as those of our global community. Thus, infrastructural resources for the conduct of research provided through opportunities such as this one, translate into immediate tangible benefits which add to our ongoing building of research capacity. These benefits also trickle down to the local and state economy via employment opportunities and technological advancements resulting from the achievement of ensued research activities.

As President of West Virginia State University, I reiterate our institutional commitment and wholeheartedly support this proposal and collaborative research endeavor.

Sincerely,

A handwritten signature in black ink that reads "Hazo W. Carter Jr." in a cursive style.

Hazo W. Carter Jr.,

President,

### **Postdoctoral Researcher Mentoring Activities**

**Career counseling:** All postdoctoral researchers will receive career counseling from their advisors and WVNano and symposia speakers from academia, national labs and industry. Postdocs will be given an opportunity to meet with these speakers individually in order for them to learn more about diverse career opportunities.

**Grant proposal, publication, and presentation training:** Postdoctoral researchers will gain useful training in grant proposal writing by helping the supervising faculty with writing individual investigator and group proposals. In addition, postdocs have the ability to be PI's of their own proposals because of their official classification as Research Faculty at WVU, and they will be encouraged to do so. At MU, postdocs will be encouraged to be formal co-PI's on grant submissions. Supervising faculty will help proofread and advise on such proposal writing activities. Postdocs will be expected to write their own papers and design their own oral presentations for conferences. Supervising faculty will advise them on their technical writing and presentation skills by proofreading drafts and practicing talks prior to attending a conference.

**Teaching and mentoring skills:** Postdocs interested in a career in academia will be given the opportunity to teach one course a year in their home department. Their teaching performance will be evaluated through student evaluations and a peer evaluation by a senior faculty member and feedback will be provided to identify strengths and weaknesses and ways on how to correct the latter. All postdocs will be expected to work closely with and mentor graduate and undergraduate students and teachers involved with their research projects.

**Diversity training:** Because of the nature of the proposed research, the postdocs will acquire valuable skills in managing highly interdisciplinary research programs where the mentees (graduate and undergraduate students, PUI researchers, and high school teachers during the summer) come from a variety of departments and have vastly different backgrounds and talents. Postdocs will also receive a one-day training course from the Office of Social Justice at WVU and MU on diversity issues, including dealing with unconscious biases and common pitfalls. The supervising faculty will discuss management and diversity issues with the postdocs at weekly meetings.

**Responsible professional practices:** All postdocs will be required to attend a half day seminar on scientific ethics, including issues related to scientific honesty, the importance of careful data acquisition and analysis, intellectual freedom, intellectual openness, credit and plagiarism, and public responsibility. Common pitfalls and ways to avoid them will be discussed. This course is based on existing material created for the WVNano REU Site and course material available at the WVU Health Sciences Center and the School of Medicine at Marshall. The Technical Director of the proposal, Dr. David Lederman, will be responsible for organizing this activity.