2016 HBCU-UP/CREST PI/PD Meeting

Program Book

FEBRUARY 24-25, 2016

RENAISSANCE WASHINGTON DC HOTEL • WASHINGTON, DC

2016 HBCU-UP/CREST PI/PD Meeting

Program Book

Co-hosted by the
American Association for the Advancement of Science (AAAS)
Education and Human Resources Program (EHR)

National Science Foundation (NSF)
Division of Human Resources Development (HRD)
Directorate of Education and Human Resources Program

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

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Program Book Editors: Yolanda S. George, AAAS, EHR
Donna Behar, AAAS, EHR
Nicole Davies, AAAS, EHR

Program Book Cover Design: Elise Swinehart, AAAS

Program Book Design: Donna Behar, AAAS, EHR

Contents

Overview of the Meeting

2016 HBCU-UP/CREST PI/PD Meeting

The objective of the **HBCU-UP/CREST PI/PD Meeting** is to provide Principal Investigators, Project Directors, and others with an opportunity to: (1) learn about and share STEM research results; (2) learn about and share innovative strategies for recruiting, preparing, and retaining undergraduate students; (3) learn about other grant opportunities at NSF; and (4) make new connections and create collaborations.

About the NSF Centers of Research Excellence in Science and Technology (CREST) Program

The **Centers of Research Excellence in Science and Technology (CREST)** program provides support to enhance the research capabilities of minority-serving institutions (MSI) through the establishment of centers that effectively integrate education and research. MSIs of higher education denote institutions that have undergraduate enrollments of 50% or more (based on total student enrollment) of members of minority groups underrepresented among those holding advanced degrees in science and engineering fields: African Americans, Alaska Natives, American Indians, Hispanic Americans, Native Hawaiians, and Native Pacific Islanders. CREST promotes the development of new knowledge, enhancements of the research productivity of individual faculty, and an expanded presence of students historically underrepresented in science, technology, engineering, and mathematics (STEM) disciplines. CREST Postdoctoral Research Fellowship (PRF) awards provide research experience and training for early career scientists to work at active CREST Centers to meet the CREST Program goal of building the research capacity of MSIs and advancing the nation's STEM workforce and leadership. HBCU-RISE awards specifically target HBCUs to support the expansion of institutional research capacity as well as the production of doctoral students, especially those from groups underrepresented in STEM, at those institutions.

The **CREST** program supports the following types of projects:

CREST Center awards provide multi-year support (typically 5-years) for eligible minority-serving institutions that demonstrate a strong research and education base, a compelling vision for research infrastructure improvement, and a comprehensive plan with the necessary elements to achieve and sustain national competitiveness in a clearly defined area of national significance in science or engineering research. Successful Center proposals will demonstrate a clear vision and synergy with the broad goals of the CREST Program and the Human Resource Development Division with respect to development of a diverse STEM workforce. CREST Centers are expected to provide leadership in the involvement of groups traditionally underrepresented in STEM at all levels (faculty, students, and postdoctoral researchers) within the Center. Centers are required to use either proven or innovative mechanisms to address issues such as recruitment, retention and mentorship of participants from underrepresented groups.

CREST Partnership Supplements support the establishment or strengthening of partnerships and collaborations between active CREST Centers and nationally or internationally recognized research centers including NSF-supported research centers, and private sector research laboratories, K-12 entities including museums and science centers or schools, as appropriate to enable the CREST Centers to advance knowledge and education on a research theme of national significance.

CREST Postdoctoral Research Fellowship (PRF) awards recognize beginning CREST Center investigators with significant potential and provide them with research experiences that broaden perspectives, facilitate interdisciplinary interactions and establish them in positions of leadership within the scientific community. Fellows conduct research on topics aligned with the research focus of the host CREST Center. The fellowships are also designed to provide active mentoring to the Fellows by the sponsoring CREST Center scientists who, in turn, will benefit from the incorporation of these talented scientists into their research groups.

HBCU Research Infrastructure for Science and Engineering (RISE) awards support the development of research capability at Historically Black Colleges and Universities that offer doctoral degrees in science and engineering disciplines. Supported projects must have a unifying research focus in one of the research areas supported by NSF, a direct connection to the long-term plans of the host department(s), institutional strategic plan and mission, and plans for expanding institutional research capacity as well as increasing the production of doctoral students, especially those underrepresented in STEM.

SBIR/STTR Phase IIa Diversity Collaboration Supplements provide an opportunity for existing SBIR/STTR Phase II projects to initiate collaborations with minority-serving institutions that have active CREST Center or HBCU-RISE awards. These supplemental proposals are administered by and co-funded with the NSF Directorate for Engineering Division of Industrial Innovation and Partnerships (ENG/IIP).

EDUCATIONAL OPPORTUNITY:
This program provides educational opportunities for Undergraduate Students. This program provides indirect funding for students at this level or focuses on educational developments for this group such as curricula development, training or retention. To inquire about possible funding opportunities not directly from NSF, please look at the active awards for this program.

About the NSF Historically Black Colleges and Universities Program (HBCU-UP) Program

Historically Black Colleges and Universities (HBCUs) have awarded a large share of bachelor's degrees to African American students in science, technology, engineering and mathematics (STEM), and nine of the top ten baccalaureate institutions of African American STEM doctorate recipients from 2008-2012 are HBCUs.[1] In 2012, 8.5% of black undergraduates attended HBCUs.[2] In contrast, HBCUs awarded 16.7% of the bachelor's degrees and 17.8% of the S&E bachelor's degrees to black students that year.[1] To meet the nation's accelerating demands for STEM talent, more rapid gains in achievement, success and degree production in STEM for underrepresented minority populations are needed. The Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) is committed to enhancing the quality of undergraduate STEM education and research at HBCUs as a means to broaden participation in the nation's STEM workforce. To this end, HBCU-UP provides awards to develop, implement, and study evidence-based innovative models and approaches for improving the preparation and success of HBCU undergraduate students so that they may pursue STEM graduate programs and/or careers. Support is available for Targeted Infusion Projects, Broadening Participation Research Projects, Research Initiation Awards, Implementation Projects, Achieving Competitive Excellence Implementation Projects, and Broadening Participation Research Centers; as well as other funding opportunities.

Targeted Infusion Projects (TIP) provide support to achieve a short-term, well-defined goal to improve the quality of undergraduate STEM education at HBCUs. The Broadening Participation Research (BPR) in STEM Education track provides support for research projects that seek to create and study new theory-driven models and innovations related to the participation and success of underrepresented groups in STEM undergraduate education. Research Initiation Awards (RIA) provide support for STEM faculty at HBCUs to pursue research at the home institution or at an NSF-funded research center, a research intensive institution or a national laboratory. Implementation Projects provide support to design, implement, study, and assess comprehensive institutional efforts to increase the number of students receiving undergraduate degrees in STEM and enhance the quality of their preparation by strengthening STEM education and research. Within this track, Achieving Competitive Excellence (ACE) Implementation Projects are intended for HBCUs with exemplary achievements and established institutionalized foundations from previous Implementation Project grants. Broadening Participation Research Centers provide support to conduct world-class research at institutions that have held three rounds of Implementation or ACE Implementation Projects.

Broadening Participation Research Centers are expected to represent the collective intelligence of HBCU STEM higher education, and serve as the national hub for the rigorous study and broad dissemination of the critical pedagogies and culturally sensitive interventions that contribute to the success of HBCUs in educating African American STEM undergraduates. Centers are expected to: conduct research on STEM education and broadening participation in STEM; perform outreach to HBCUs to build capacity to conduct this type of research; and work to transfer and disseminate promising broadening participation research to enhance STEM education and research outcomes for African American undergraduates across the country.

EDUCATIONAL OPPORTUNITY:
This program provides educational opportunities for Undergraduate Students. This program provides indirect funding for students at this level or focuses on educational developments for this group such as curricula development, training or retention. To inquire about possible funding opportunities not directly from NSF, please look at the active awards for this program.

[1] National Science Foundation, National Center for Science and Engineering Statistics. 2013. Women, Minorities, and Persons with Disabilities in Science and Engineering: 2013, Special Report NSF 13-304. Arlington, VA. Available from *http://www.nsf.gov/statistics/wmpd/.*

[2] U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. 2012. Digest of Education Statistics. NCES 2014-015. Washington, DC. Available from: *http://nces.ed.gov/programs/digest/d12/.*

About NSF

The National Science Foundation (NSF) Division of Human Resource Development (HRD)

The **Division of Human Resource Development (HRD)** serves as a focal point for NSF's agency-wide commitment to enhancing the quality and excellence of STEM education and research through broadening participation by historically under-represented groups - minorities, women, and persons with disabilities. Priority is placed on investments that promise innovation and transformative strategies and that focus on creating and testing models that ensure the full participation of and provide opportunities for the educators, researchers, and institutions dedicated to serving these populations. Programs within HRD have a strong focus on partnerships and collaborations in order to maximize the preparation of a well-trained scientific and instructional workforce for the new millennium.

HRD Vision:

HRD envisions a well-prepared and competitive U.S. workforce of scientists, technologists, engineers, mathematicians, and educators that reflects the diversity of the U.S. population.

HRD Mission:

HRD's mission is to grow the innovative and competitive U.S. science, technology, engineering and mathematics (STEM) workforce that is vital for sustaining and advancing the Nation's prosperity by supporting the broader participation and success of individuals currently underrepresented in STEM and the institutions that serve them.

Strategic Goal 1:

The creation of new knowledge, innovations, and models for broadening participation in the STEM enterprise.

Strategic Goal 2:

The translation of knowledge, innovations, and models for broadening participation in STEM for use by stakeholders.[1]

Strategic Goal 3:

Expand Opportunities: The expansion of stakeholder capacity to support and engage diverse populations in high quality STEM education and research programs.

HRD Theory of Change:

HRD's fundamental mission of broadening participation in STEM is embedded in the greater EHR and NSF goals. A basic premise of all HRD programs is that increasing the successful participation of individuals from historically underrepresented groups in STEM will result in a diverse, highly capable STEM workforce that can lead innovation and sustain U.S. competitiveness in the science and engineering enterprise.

Therefore, HRD has an overall goal to increase the successful participation of underrepresented minorities, women and girls, and persons with disabilities in STEM. This is done through the implementation and testing of evidence-based practices, critical review of program results to assess impact, data-driven continuous improvement, and broad dissemination of program findings for wide adoption or scale-up of effective strategies.

[1]Stakeholders include a wide range of organizations and individuals such as but not limited to: NSF and other Federal agencies, federally funded STEM labs and centers, institutions of higher education including minority-serving institutions, state and local governments, education researchers and practitioners, policy makers, STEM employers, professional STEM societies, STEM organizations, and private funders.

The American Association for the Advancement of Science (AAAS)

The **American Association for the Advancement of Science** is an international non-profit organization dedicated to advancing science around the world by serving as an educator, leader, spokesperson and professional association. In addition to organizing membership activities, AAAS publishes the journal *Science,* http://www.sciencemag.org/, as well as many scientific newsletters, books and reports, and spearheads programs that raise the bar of understanding for science worldwide.

AAAS was founded in 1848, and includes some 261 affiliated societies and academies of science, serving 10 million individuals. *Science* has the largest paid circulation of any peer-reviewed general science journal in the world, with an estimated total readership of one million. The non-profit AAAS is open to all and fulfills its mission to "advance science and serve society" through initiatives in science policy; international programs; science education; and more. For the latest research news, log onto EurekAlert!, http://www.eurekalert.org/, the premier science-news website, a service of AAAS.

Membership and Programs

Open to all, AAAS membership includes a subscription to *Science.* Four primary program areas fulfill the AAAS mission:

- Science and Policy
- International Activities
- Education and Human Resources
- Project 2061

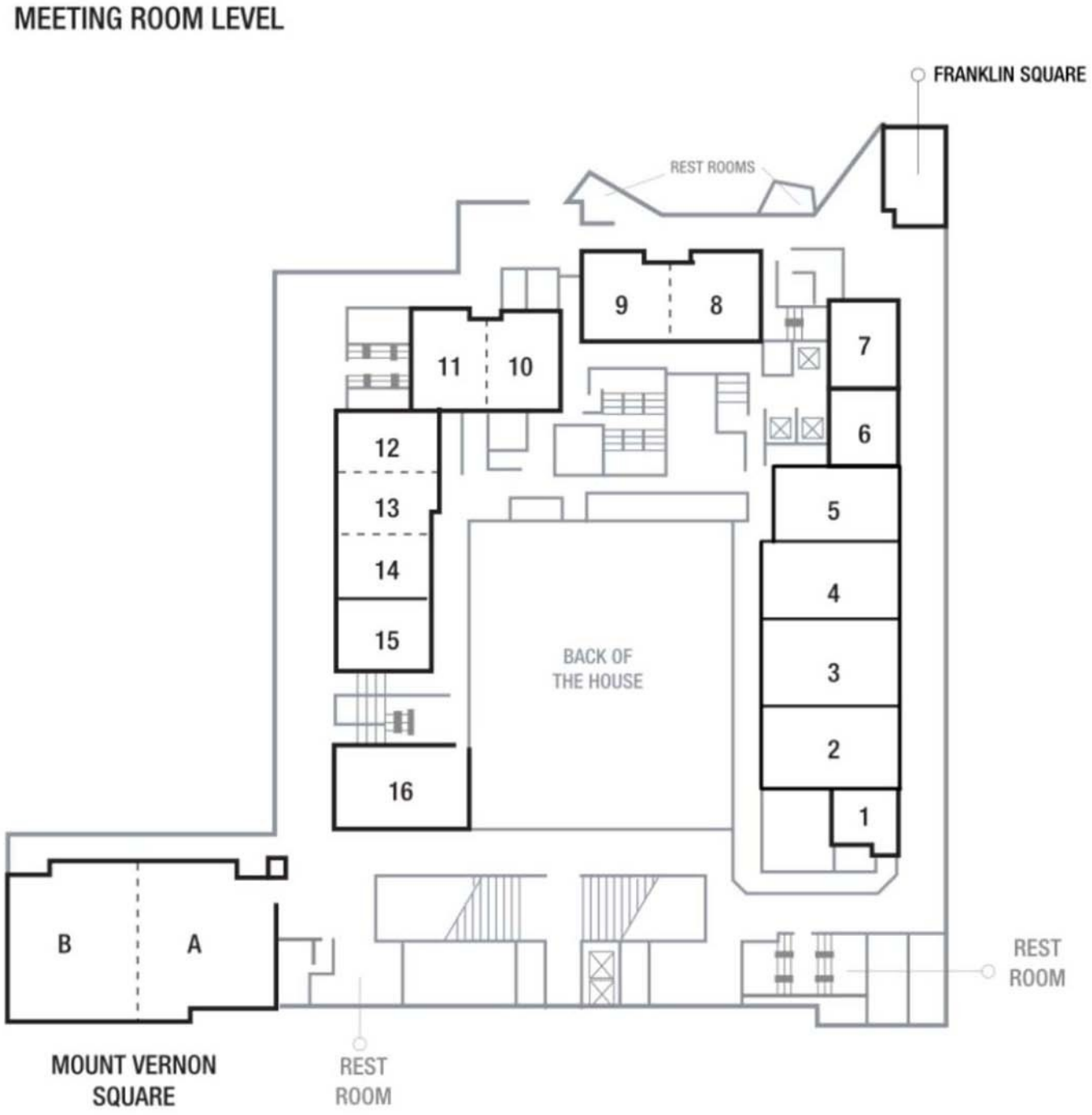
AAAS Mission

AAAS seeks to "advance science, engineering, and innovation throughout the world for the benefit of all people." To fulfill this mission, the AAAS Board has set these broad goals:

- Enhance communication among scientists, engineers, and the public;
- Promote and defend the integrity of science and its use;
- Strengthen support for the science and technology enterprise;
- Provide a voice for science on societal issues;
- Promote the responsible use of science in public policy;
- Strengthen and diversify the science and technology workforce;
- Foster education in science and technology for everyone;
- Increase public engagement with science and technology; and
- Advance international cooperation in science.

Visit the AAAS website at http://www.aaas.org/.

Hotel Floor Plans



Wednesday, February 24, 2016

2:00pm — **HBCU-UP/CREST PI/PD Meeting Registraton**
Grand Registration

3:00pm - 3:30pm — **Opening Plenary Session 1**
Mount Vernon Square

Welcome:
Sylvia M. James, *Division Director, HRD, NSF*

"New Opportunities"

3:30pm - 5:00pm — **Concurrent Business Meetings**
Mount Vernon Square A&B

A. CREST Business Meeting
Mount Vernon Square A

NSF Program Officers

B. HBCU-UP Business Meeting
Mount Vernon Square B

NSF Program Officers

5:00pm - 6:30pm — **Poster Session 1 and Reception**
Congressional A&B

6:30pm - 8:00pm — **Poster Session 2 and Reception**
Congressional A&B

Thursday, February 25, 2016

Breakfast On Your Own

8:30am - 9:30am — **Concurrent Breakouts – Session 1**

A. Lightning Talk Group 1 – CREST
Meeting Room 2

Victor Santiago, *Program Director, NSF*

Andrea Johnson, *Program Director, NSF*

B. Lightning Talk Group 2 – HBCU-UP Implementation
Meeting Room 3

Claudia Rankins, *Program Director, NSF*

C. Lightning Talk Group 3 – HBCU-UP TIP Projects
Meeting Room 4

Rebecca Bates, *Program Director, NSF*

D. Lightning Talk Group 4 – HBCU-UP RIA Projects
Meeting Room 5

Martha James, *Program Director, NSF*

E. Lightning Talk Group 5 – HBCU-UP BPR Projects
Meeting Room 15

Earnestine Easter, *Program Director, NSF*

9:30am - 9:45am — **Break**

9:45am - 10:45am — **Concurrent Breakouts – Session 2**

A. Lightning Talk Group 1 – CREST
Meeting Room 2

Victor Santiago, *Program Director, NSF*

Andrea Johnson, *Program Director, NSF*

B. Lightning Talk Group 2 – HBCU-UP Implementation
Meeting Room 3

Claudia Rankins, *Program Director, NSF*

C. Lightning Talk Group 3 – HBCU-UP TIP Projects
Meeting Room 4

Rebecca Bates, *Program Director, NSF*

D. Lightning Talk Group 4 – HBCU-UP RIA Projects
Meeting Room 5

Martha James, *Program Director, NSF*

Andrea Johnson, *Program Director, NSF*

Agenda

E. Lightning Talk Group 5 – HBCU-UP BPR Projects
Meeting Room 15

Earnestine Easter, *Program Director, NSF*

10:45am - 11:00am **Break**

11:00am - Noon **Concurrent Breakouts – Session 3**

A. Assessment of Student Outcomes
Meeting Room 2

Melvin Hall, *Professor of Educational Psychology at Northern Arizona University*

B. New PI Orientation
Meeting Room 3

Claudia Rankins, *Program Director, NSF*

Andrea Johnson, *Program Director, NSF*

C. Project Documentation and Dissemination
Meeting Room 4

Earnestine Easter, *Program Director, NSF*

Michael Sullivan, *Communications Specialist, NSF*

Rob Margetta, *Public Affairs Specialist, NSF*

Noon - 2:00pm **Plenary Session 2 and Lunch**
Mount Vernon Square

Moderator:
Claudia Rankins, *Program Director, NSF*

Keynote Speaker:
Becky Wai-Ling Packard, *Associate Dean of Faculty; Professor of Psychology and Education; Director of the Harriet L. and Paul M. Weissman Center for Leadership*

2:00pm - 3:00pm **Concurrent Breakouts – Session 4**

A. NSF Program Updates
Mount Vernon Square

Improving Undergraduate STEM Education (IUSE)

EHR Core Research (ECR)

NSF Scholarships in Science, Technology, Engineering and Mathematics (S-STEM)

Cyber Corps Scholarship for Service

Earnestine Easter, *Program Director, NSF*

Gul Kremer, *Program Director, NSF*

Karen Crosby, *Program Director, NSF*

2:00pm - 3:00pm **B. NSF Program Updates**
Congressional C

Major Research Instrumentation (MRI)

Research Experiences for Undergraduates (REU)

Faculty Early Career Development Program (CAREER)

Innovations at the Nexus of Food Energy and Water Systems (INFEWS)

Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE)

Claudia Rankins, *Program Director, NSF*

Kathy McCloud, *Program Director, NSF*

Dana Britton, *Program Director, NSF*

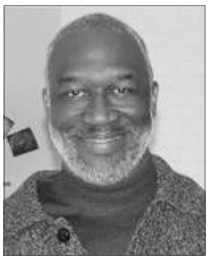
Yolanda S. George, *Deputy Director, Education and Human Resources, AAAS*

Yolanda Scott George is Deputy Director and Program Director, Education and Human Resources Programs, American Association for the Advancement of Science (AAAS). She has served as Director of Development, Association of Science-Technology Centers (ASTC), Washington, DC; Director, Professional Development Program, University of California, Berkeley, CA; and as a research biologist at Lawrence Livermore Laboratory, Livermore, California involved in cancer research and cell cycle studies using flow cytometer and cell sorters.

George conducts evaluations, workshops and reviews for the National Institutes of Health and National Science Foundation, as well as for private foundation and public agencies, including the European Commission. She develops and coordinates conferences and workshops related to STEM undergraduate reform and recruitment and retention of minorities, women, and persons with disabilities in STEM. She works with UNIFEM, UNESCO, L'Oreal USA and Paris, and non-governmental organizations on gender, science, and technology initiatives related to college and university recruitment and retention and women leadership in STEM.

She currently serves as principal investigator (PI) or co-PI on several National Science Foundation (NSF) grants, including Vision and Change in Undergraduate Biology Education; National Science Education Digital Library (NSDL) Biological Sciences Pathways; Historically Black Colleges and Universities-Undergraduate Programs (HBCU-UP); Robert Noyce Teacher Scholarship Program; Transforming Undergraduate Education in STEM (TUES) and Virtual Faculty Workshop; and Women's International Research Collaborations at Minority Serving Institutions. In addition, George is the lead AAAS staff person for the L'Oréal USA Fellowships for Women in Science Program (postdoctoral fellowships) and the David and Lucile Packard Foundation HBCU Graduate Scholars Program (graduate school fellowships).

George serves on a number of boards or committees, including: Maria Mitchell Women in Science Awards Committee; McNeil/Lehrer Productions Online Science Reports Advisory Committee; Burroughs Wellcome Fund, Science Enrichment Program Grants, Advisory Board; The HistoryMakers, ScienceMakers, Advisory Board; and the National Advisory Board of The American Physical Society Physics Bridge Program. She has authored or co-authored over 50 papers, pamphlets, and hands-on science manuals. She received her BS and MS from Xavier University of Louisiana and Atlanta University in Georgia, respectively.



Melvin E. Hall, *Professor of Educational Psychology, Northern Arizona University*

Melvin E. Hall is Professor of Educational Psychology at Northern Arizona University. Hall completed his BS, and PhD, degrees at the University of Illinois at Urbana Champaign in Social Psychology and Educational Psychology respectively; and M.S. in Counseling at Northern Illinois University.

During a forty plus-year professional career in higher education, Hall has served in four successive appointments, as an academic dean, comprised of positions at Florida Atlantic University, University of California-Irvine, University of Maryland at College Park, and most recently Northern Arizona University (NAU). At NAU, Hall served as Dean of the College of Education and additionally was the principal investigator on two five-year US Office of Education GEAR UP grants providing dropout prevention programs and services to thousands of middle and high school students throughout Arizona.

Returning to full-time faculty life in 2002, Hall has melded teaching and scholarship in Educational Psychology with responsibility as co-principal investigator on five-years of National Science Foundation support for the Relevance of Culture in Evaluation Institute. Subsequent to the RCEI grant, Hall began a continuing appointment as affiliated faculty in the Center for Responsive Evaluation and Assessment (CREA) at the University of Illinois. As an external reviewer, Hall has served on numerous review panels and Committee of Visitors for the National Science Foundation EHR Division including an invited expert panel on the future of evaluation methodology in STEM programs. In 2015, he accepted an appointment as an intermittent expert at NSF and in that, capacity serves as a program officer for the ADVANCE and HBCU UP Programs within the Human Resource Development Division of the EHR Directorate.

For several years, Hall served on the American Evaluation Association Standing Committee on Diversity, initiating the association's published statement on the importance of Cultural Competence in the field of Program Evaluation. In 2013, Dr. Hall became an elected member of the American Evaluation Association Board of Directors.

Sylvia M. James, *Division Director, HRD, NSF*

Sylvia M. James is the Director of the Division of Human Resource Development (HRD) in the National Science Foundation's (NSF) Directorate for Education and Human Resources (EHR). As Division Director, she oversees a $129 million

budget and a talented team of 25 scientific and administrative staff. The mission of HRD, as exemplified by its seven longstanding programs, is to contribute to the creation of "…a well-prepared and competitive workforce of scientists, technicians, engineers, mathematicians, and educators that reflects the diversity of the U.S. population."

During her 15 year tenure at NSF, she has served as the Acting Division Director of the Division of Human Resource Development, Acting Director and Acting Deputy Division Director of the Division of Research on Learning in Formal and Informal Settings ($221 million budget), and the Lifelong Learning Cluster Coordinator. As Cluster Coordinator, she managed the Informal Science Education Program (ISE) and the associated budget of $64 million, while also providing direction for the Innovative Technology Experiences for Students and Teachers (ITEST) program. She has served as a program officer for the ISE, ITEST, Faculty Early Career (CAREER), and the Advanced Technological Education (ATE) programs. She also worked with the Innovation through Institutional Integration (I3) and Academies for Young Scientists (AYS) programs. James previously served as the Lead Program Officer for ITEST, and its predecessor, the After School Centers for Exploration and New Discovery (ASCEND). She currently serves as the Co-Chair of the Federal Coordination in STEM (FC-STEM) Broadening Participation Interagency Working Group, the NSF liaison to the Liaison to President's Board of Advisors (PBA) on HBCUs, and has been a member of the Burroughs Wellcome Fund, Student Science Enrichment Program (SSEP) Advisory Committee since 2012. She is currently a member of the interagency working group for the White House Initiative on Educational Excellence for Hispanics (WHIEEH). She previously served on the Interagency Working Group for Youth Programs (2012-2014) and the 21st Century Community Learning Centers, Interagency Technical Working Group (2011-2014).

Prior to coming to NSF, she was the Director of Education at the National Aquarium in Baltimore where she was employed for 14 years. While at the National Aquarium, she directed teacher training and youth enrichment projects supported by national funders such as the Howard Hughes Medical Institute, DeWitt Wallace Readers Digest Fund, and the National Science Foundation, as well as an assortment of local foundations. She has served as an education consultant for science education radio, youth publications, and museums and an adjunct science faculty member at Sojourner-Douglass College in Baltimore. James is the author of seven children's books on marine animals, in addition to science education publications and reports. She holds a Bachelor of Science degree in Biology from Loyola University, a Master of Science degree from the Johns Hopkins University, and a Doctorate in Science Education from Morgan State University, all located in Baltimore, Maryland.

Andrea Johnson, *Program Director, HRD, NSF*

Andrea Johnson joined the National Science Foundation in 2014 as a rotator Program Director in the Division of Human Resource Development (HRD) in the Directorate of Education and Human Resources (EHR). She manages the Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) and the Centers of Research Excellence in Science and Technology (CREST) program. Prior to coming to NSF, she was a Research Assistant Professor in the NOAA Living Marine Resources Cooperative Science Center (LMRCSC) at the University of Maryland Eastern Shore (UMES) where she conducted research in the areas of physiology, reproductive biology and life history of marine and estuarine fish species.

During her tenure at UMES, she served as the Associate Director for the National Science Foundation's CREST Center for the Integrated Study of Coastal Ecosystem Processes and Dynamics in the Mid-Atlantic Region. She has also directed several K-12 STEM education and outreach activities for teachers and students. Johnson obtained her BS degree in Marine Science from the University of Miami, her MS in Marine Science from the University of South Florida and her PhD in Comparative Biomedical Sciences at the North Carolina State University College of Veterinary Medicine.

Shirley M. Malcom, *Director for Education and Human Resources (EHR) Programs, AAAS*

Shirley M. Malcom, Director for Education and Human Resources (EHR) Programs at AAAS, has served as a program officer in the NSF Science Education Directorate; an assistant professor of biology, University of North Carolina, Wilmington; and a high school science teacher. Malcom received her PhD in Ecology from the Pennsylvania State University; Master's in Zoology from the University of California, Los Angeles; and Bachelor's with distinction in Zoology from the University of Washington. In addition, she holds 16 honorary degrees.

Malcom serves on several boards, including the Heinz Endowments, Public Agenda, Digital Promise, and the National Mathematics and Science Initiative. She serves as a trustee of Caltech and as a Regent of Morgan State University. In 2003, Malcom received the Public Welfare Medal of the National Academy of Science, the highest award granted by the Academy. She was a member of the National Science Board, the policymaking body of NSF, from 1994 to 1998, and of the President's Committee of Advisors on Science and Technology from 1994 to 2001.

Claudia Rankins, *Program Director, HRD, NSF*

Claudia Rankins is a Program Officer in the Directorate for Education and Human Resources at the National Science Foundation, where she manages the Historically Black Colleges and Universities Undergraduate Program and the Centers for Research Excellence in Science and Technology. Prior to this post, Rankins served at Hampton University for 22 years in a number of capacities, including Chair of the Department of Physics, Assistant Dean for Research, and dean of the School of Science. Rankins holds a PhD in Physics from Hampton University. She is the co-founder of the Society of STEM Women of Color, Inc.

Victor Santiago, *Program Director, HRD, NSF*

Victor Santiago is a Program Director in the National Science Foundation's Division of Human Resource Development (HRD). This Division implements programs and activities that enhance the quantity, quality and diversity of human capital engaged in U.S. science, technology, engineering, and mathematics (STEM). A principal focus of HRD is to ensure access to and full participation in STEM through increased, improved and diversified opportunities; enhanced quality in the educational experience; and hands-on research experiences. In particular, HRD plays a central role in increasing opportunities in STEM education for individuals from historically underserved populations—minorities, women and persons with disabilities—and supports the development of the educators, researchers, and institutions dedicated to serving these populations. During his sixteen-year tenure at NSF, Dr. Santiago has served as Program Manager for several national STEM research and education programs. He also served as Acting Division Director, HRD and as Deputy Division Director, HRD.

Prior to his appointment at the National Science Foundation, Dr. Santiago was an Associate Professor of Earth Science at Inter American University of Puerto Rico. There, he also held several administrative positions including Dean of Science and Technology. Dr. Santiago earned a Ph.D. at the University of Michigan.

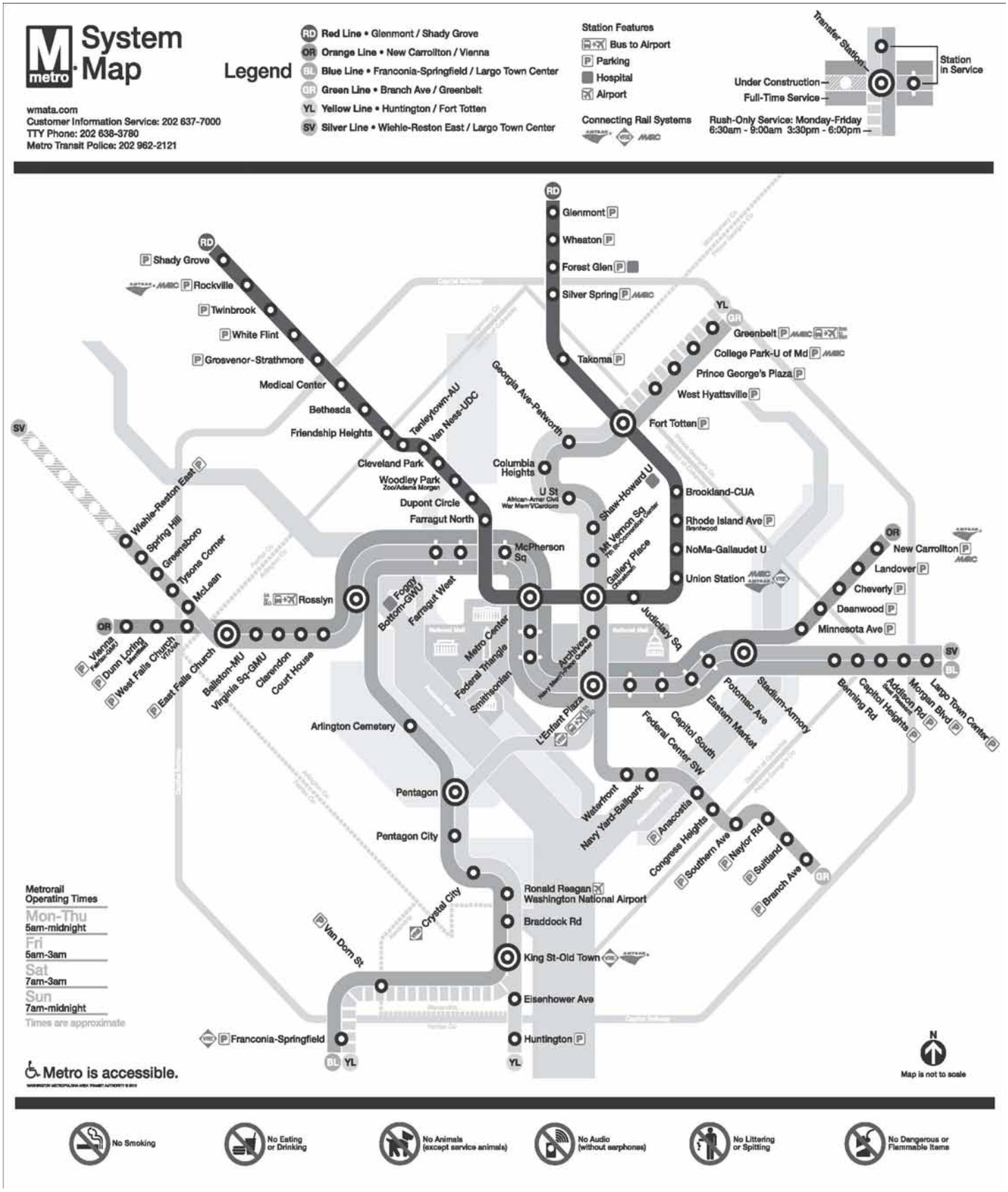
Becky Wai-Lang Packard, *Associate Dean of Faculty; Professor of Psychology and Education; Director of the Harriet L. and Paul M. Weissman Center for Leadership*

Becky Wai-Ling Packard is a professor of psychology and education and is the Director of the Weissman Center for Leadership. At the Weissman Center, she oversees all initiatives, and she is responsible for Teaching and Learning Initiatives and new faculty mentoring. Packard is interested in the intersection of motivation, identity, and mentoring. She aims, she says, "to understand how young people without easily identifiable role models and mentors in career domains manage to find the mentoring they need and sustain their desired possible selves, or who they hope to become in the future." Packard's research focuses on mentoring, with an emphasis on how individuals such as first-generation college students, women, and persons of color construct mentoring networks as they navigate complex pathways toward higher education and work. She frequently speaks on these topics at the local, state, and national level. She also offers expert advice on ways to design mentoring and advising initiatives for students and faculty.

Her work has been supported by the National Science Foundation's CAREER, Gender in Science and Engineering, and Division of Undergraduate Education programs. In June 2005, she went to the White House to receive the Presidential Early Career Award for Scientists and Engineers (PECASE), the highest honor bestowed by the U.S. government upon early career scientists. She is currently a co-principal investigator on a Google-funded initiative where she is contributing to the peer mentoring design within computer science. Community-based learning partnerships are an important part of Packard's work, based on years of collaborations with schools and organizations in Holyoke and Springfield. She received the Volunteer of the Year Award from Girls Inc., Holyoke. As a first-generation college graduate herself, Packard is especially appreciative of how the numerous contexts of home, school, community, and work need to come together to support the educational progress of students.

Packard is the author of the 2015 publication *Successful STEM Mentoring Initiatives for Underrepresented College Students*, a step-by-step, research-based guide for higher education faculty and administrators who are charged with designing mentoring programs to recruit and retain students from underrepresented groups.

Washington, D.C. Subway System Map



Biological Sciences

1

Poster Category: STEM Research

Do Lessons from Model Institutions of Excellence Work Elsewhere? An Assessment of Impact of A Comprehensive Support on Success in Two Gateway Biology

Eyualem Abebe, Elizabeth City State University
Co-Author(s): Rebecca Jordan, Rutgers University

The Department of Biology, Elizabeth City State University (an HBCU), has the second largest student enrollment of all university departments, with close to a total of 300 students. However, in the past ten years the program has been seriously challenged by a 40-50% student failure rate in the two introductory gateway Biology courses. Consequently, in 2012, we introduced a comprehensive student support program, with the goal of increasing the success of African-American students in the two introductory gateway Biology courses. Our program supports a total 25 students in three cohorts and applies the four lessons from model institutions of excellence that were reported to enhance the success of students from underrepresented groups: 1) A precollege initiative in the form of four and half week summer bridge program; 2) An academic year mentorship, counseling and student support using peer-, graduate student and faculty support; 3) Assistance in securing undergraduate research experience through close partnership with other ongoing federally funded projects; and 4) A targeted graduate school and science career preparation. The limited data based on two cohorts of students shows that the program (Application of Lessons from Model Institutions of Excellence - ALEMIE) enhances retention within the department and increases the success rate of involved students significantly. Here we report a statistically significant higher Biology course grade and overall GPA of ALEMIE participants over the control Biology Majors group.

Funder Acknowledgement: HBCU-UP, Target Infusion Grant, National Science Foundation

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Poster Category: STEM Research

How Do White Cells Survive in Variegated Epipremnum Aureum 'Marble Queen'?

Chiu-Yueh Hung, North Carolina Central University
Co-Author(s): Farooqahmed S. Kittur and Jiahua Xie, Department of Pharmaceutical Sciences, Biomanufacturing Research Institute & Technology Enterprise, North Carolina Central University
Ying-Hsuan Sun, Department of Forestry, National Chung Hsing University, Taichung, Taiwan, Republic of China
Jie Qiu and Longjiang Fan, Department of Agronomy, Zhejiang University, Hangzhou, China
Richard J Henny and Jianjun Chen, Environmental Horticulture Department and Mid-Florida Research and Education Center, Apopka, University of Florida

'Marble Queen' is a variegated plant having both green (MG) and white (MW) sectors within the same leaf, which provides a valuable system for physiological study. Apparently, the physiological statuses of cells in MG and MW sectors are very different. Thus when color deficient cells grow/develop side by side with normal green cells, they need to cope with the differences between each other and respond to the environmental conditions more efficiently than cells of a normal green leaf. To unveil their communication and interaction mechanisms, we obtained transcriptome data of green and white sectors using Next-Generation Sequencing (NGS) technology. Initial comparison results show that there are 848 differentially expressed contigs. Among them, 52.6% were more abundant while 47.4% were less abundant in MW than in MG. Contigs abundant in MW were mostly stress induced or related genes which encode proteins, such as glutathione S-transferase, heat-shock protein, Rab18, Derlin-2, and temperature-induced lipocalin. Those less abundant in MW were mostly involved in the photosystem I and II. Further metabolite analysis of green and white sectors including hormones, carotenoid and chlorophylls was performed. Morphologies of white cells and adjacent green cells were also examined in detail by TEM. All these results will lead us to understand how white cells survive in variegated plants.

Funder Acknowledgement: This study was supported by a grant from the National Science Foundation (HRD-1400946) to Jiahua Xie.

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Poster Category: STEM Research

Evolutionary and Ecological Impacts of Horizontal Gene Transfer in Arthropods

Jennifer Kovacs, Spelman College
Co-Author(s): Emily Weigel and Kiera Brown, Spelman College
Jack Werren, University of Rochester

Horizontal (or lateral) gene transfer (HGT) is the transfer of genes between distantly related organisms. In prokaryotes, HGT can result in the rapid acquisition of novel phenotypic traits, such as antibiotic resistance, which can produce adaptations and allow for niche expansion. HGT is not as well-documented among multicellular eukaryotes and it is still unclear how often it results in evolutionarily advantageous traits or traits with ecological effects. Interestingly, several cases of multiple

independent transfers of the same gene into the genomes of multiple host species have recently been found, including fungal carotenoid genes in aphids, the two-spotted spider mite, and gall midges; and a bacterial cell wall degrading gene in aphids and mealybugs. In both of these cases, these genes appear to be functional and to have ecological relevance for their host species. Recently, our group has begun using publically available gene expression and genomic data to identify cases of shared horizontally transferred genes among arthropods that occupy the same ecological niche. To do this, we designed two independent bioinformatic pipelines to identify genes that were shared by distantly related niche-sharing arthropods, but absent in more closely non-niche sharing relatives. Here we present several candidate HT genes that are shared among blood-feeding arthropods, but absent in more closely related phloem-feeding relatives. These genes will be further characterized using gene expression analysis and phylogenetic trees to determine their possible function and origin.

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Poster Category: STEM Research

The Transcription Factor FKH-8 is Essential for Dopamine Neuron Function

Brian L. Nelms, Fisk University
Co-Author(s): Erica Tross, Bobby Jones, Corey Roach, Ke'Ara Brown-Smith, Bryan Cawthon, and Kai Bracey, Fisk University, Fisk-Vanderbilt Masters-to-PhD Bridge Program

Dopamine is an important neurotransmitter found throughout the animal kingdom that helps to regulate motor control, cognition, mood, and behavior. Dopamine levels are tightly controlled at multiple steps including dopamine biosynthesis, vesicle packaging, neuron excitability, release, reuptake, and metabolism. While some of the core components of the dopamine signaling pathway are known, we still have much more to learn about transcriptional control of dopamine neuron gene expression. In order to discover and understand new molecules involved in dopamine signaling, we use the model organism C. elegans, which has a simple nervous system that is easily observed and manipulated through both genetic and pharmacological approaches. Our work has identified the transcription factor FKH-8, a member of the highly conserved forkhead family, as an important regulator of dopamine neuron function. FKH-8 is expressed in all dopamine neurons and fkh-8 deletion mutants show an extrasynaptic dopamine-dependent motor defect, swimming-induced paralysis (SWIP), similar to mutants with a deletion of the dopamine transporter gene dat-1. However, the FKH-8 SWIP defect is independent of DAT-1, as dat-1 expression levels are unchanged, and DAT-1 function is intact. We are using genetic and pharmacological approaches to more precisely determine the position of FKH-8 within the dopamine signaling pathway, particularly in dopamine metabolism. We have also performed RNA-Seq from sorted dopamine neurons to identify potential gene targets of FKH-8 and genes that are upregulated in dopamine neurons in general. This strategy is helping us to uncover additional novel regulators of dopamine neuron development, maintenance, and function.

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Poster Category: STEM Research

The Genetic Code: Pathways of the 20 Standard Amino Acids

Joseph Onyilagha, University of Arkansas at Pine Bluff
Co-Author(s): D. Machooka and M. Moorehead, University of Arkansas at Pine Bluff
S. Freeland, University of Maryland, Baltimore County

The origin of genetic coding is intriguing. From a pool of available molecules, life ended up using four nucleotides and twenty amino acids to encode and build its proteins. By the time of the Last Universal Common Ancestor (LUCA), the process of protein translation was largely fixed in the form of the standard genetic code. The intention of this research is to determine whether metabolic pathways found in living organisms are indeed an accurate guide to ancient evolutionary events. The project goal is to provide additional insight into the emergence of a standard alphabet of 20 genetically encoded amino acids. Consequently, we investigated the assertion that the 20 standard amino acids of the genetic code consists of early and late members, and that the late amino acids are ‘inventions’ of early metabolism. In other words, genetic coding began with fewer than 20 amino acids. This ‘early’ alphabet (comprising prebiotically plausible amino acids) was then augmented as metabolism evolved new possibilities, and incorporated them into genetic coding. Contemporary data from databases were used. Pathways to amino acid biosynthesis were analyzed. The synquences of enzymes catalyzing the pathways were also studied. Our findings are consistent with earlier reports that the 20 amino acids of the standard genetic code comprise of two different groups: ‘early’ amino acids that were likely available at the origin for life through prebiotic syntheses, and ‘late’ amino acids that are best understood as inventions of biology itself. The results show that steps in the biosynthetic pathways of many of the late amino acids are longer than those of the early amino acids. Again, longer step means the involvement of many more enzymes. Additionally, late amino acid members are

synthesized through several more pathways than the early amino acids.

However, our results are at variance with some of the theories surrounding the evolution or emergence of the 20 encoded amino acids of the standard genetic code, especially the 'precursor-product' assertion of the 'Co-Evolution theory'. Firstly, the theory asserts that each new amino acid (product) is synthesized from a pre-existing precursor. For example glutamine is synthesized from glutamic acid; tryptophan and cysteine are synthesized from serine. Secondly, the theory asserts that this relationship is reflected in the assignment of amino acids to codons within the genetic code. These assertions are inconsistent with our findings. For example, there is no precursor-product relationship that connects Glycine (Gly) and Threonine (Thr) amino acids as claimed by the Co-Evolutionary theory. In other words, Thr cannot be synthesized from Gly and vice-versa. Nevertheless, our results show new pathways that facilitate the biosyntheses of Thr from Gly and/or vice-versa. Consequently, we conclude that the origin of amino acids of the standard genetic code is far from being resolved and that there is need for a critical evaluation of the theories surrounding the emergence of the 20 standard amino acids.

Funder Acknowledgement: Research is funded by the NSF HBCU-UP program.

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Poster Category: STEM Research

Intestinal Sarcocystis Species Infections in Raptors from North Carolina

Alexa C. Rosypal, Johnson C. Smith University
Co-Author(s): Richard O. Sawyer and David S. Lindsay, Department of Biomedical Sciences and Pathology, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, VA
David Scott, Carolina Raptor Center, Huntersville, NC

The diversity of Sarcocystis spp infecting raptors is not well known. The intestinal tracts from 6 raptors (1 red-tailed hawk (RTH), 1 red-shouldered hawk (RSH), 1 Cooper's hawk (CH), 1 screech owl (SO) and 2 barred owls (BO) a&b) were collected from terminally ill or patients that were euthanized because of they could not be rehabilitated and released at the Carolina Raptor Center. The intestinal samples were labeled and refrigerated until they were examined microscopically for parasites. Fluke eggs were seen in 3 raptors (RTH, RSH, & SO) while, capillarid eggs were seen in the RTH and spirurid eggs were seen in the RSH. Four (67%) of the 6 samples (RTH, RSH, CH & BOa) contained oocysts/sporocysts of Sarcocystis species. The intestines from the RTH, RSH, and CH were processed and sporocysts that each contained 4 sporozoites whose measurements were consistent with Sarcocystis spp. The BOa had very few sporocysts and none were collected. Infectivity of sporozoites obtained from excysted sporocysts was examined using African Green monkey kidney (CV-1) cell cultures. We have been successful in growing Sarcocystis from the CH and have observed schizonts and merozoites and kept the culture growing by sub-passage onto fresh CV-1 cells. Additionally, we have observed merozoites in cultures from the RTH and RSH but have not currently been able to generate sub-passaged cultures. We are currently collecting merozoites from the CH isolate to characterize by phylogenetic analysis using ITS and CO1 PCR primers that react with all Sarcocystis species.

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Poster Category: STEM Research

Astrocyte Neuron Interactions in Synchronous Bursting Behavior

Karla Sanchez, Delaware State University
Co-Author(s): Melissa Harrington and Murali Temburni, Delaware State University

Establishing functional neuronal networks during brain development requires synchronous oscillatory activity among neurons. However, the mechanisms of synchronization are not fully understood. Current models of neuronal synchronous activity assume that it is a process intrinsic to neurons. Evidence that glial cells particularly astrocytes modulate synchronous activity in networks of neurons is accumulating -- for example during sleep, during prodromal oscillations preceding spreading depression, and the slow inward currents (SICs) resulting in synchronous activity in hippocampal neurons, thalamus and nucleus accumbens. Astrocytes participate in neuronal communication by releasing 'gliotransmitters' like glutamate, ATP and D-serine. We hypothesize that astrocyte-neuron interactions are crucial for the development of synchronous activity seen in the developing vertebrate brain. We tested this hypothesis by establishing pure and mixed (astrocyte and neuronal) cultures from the developing chicken brain (optic tectum) and recording total neuronal activity using the multi-electrode array system, MED64. Pure neuronal cultures were obtained by treating cultures with the mitotic inhibitor 5-fluorodeoxyuridine (FUdR) which kills mitotically active astrocytes but spares post-mitotic neurons. Neurons were kept alive in the absence of astrocytes by supplementing the culture medium with 50% astrocyte conditioned medium. Mixed cultures of astrocytes and neurons show random spiking activity in one week and synchronous activity in two weeks whereas pure neuron only cultures show random spiking activity without synchronization even after two weeks - thus clearly establishing a role for astrocytes in the development of synchronous activity. To further confirm the involvement of astrocytes we have

reintroduced astrocytes into the randomly spiking pure neuronal cultures after synchronous activity was observed in the control mixed cultures. We observed an immediate increase in spiking activity which synchronized within a week of reintroduction of astrocytes into the FUdR treated pure neuronal cultures. To further dissect the molecular pathways involved, we are targeting GPCR pathways within astrocytes that mediate intracellular Calcium release. Activation of these G -protein coupled receptors by their respective neurotransmitters mobilizes intracellular calcium release leading to exocytosis of either glutamate or ATP. We are expressing dominant negative peptides designed to disrupt downstream signaling pathways of these receptors and thereby calcium mobilization and exocytosis of gliotransmitters in chick embryo astrocytes.

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Poster Category: STEM Research

Phylogenomics of 'Discosea': A New Molecular Phylogenetic Perspective on Amoebozoa with Flat Body Forms

Yonas I. Tekle, Spelman College

The majority of amoeboid lineages with flattened body forms are placed under a taxonomic hypothetical class 'Discosea' senus Smirnov et al. (2011), which encompasses some of the most diverse morphs within Amoebozoa. However, its taxonomy and phylogeny is poorly understood. This is partly due to lack of support in studies that are based on limited gene sampling. In this study we use a phylogenomic approach including newly-generate RNA-Seq data and comprehensive taxon sampling to resolve the phylogeny of 'Discosea'. Our analysis included eight of the nine orders of 'Discosea' and up to 550 genes, the largest gene sampling in Amoebozoa to date. We conducted extensive analyses to assess the robustness of our resulting phylogenies to effects of missing data and outgroup choice using probabilistic methods. All of our analyses, which explore the impact of varying amounts of missing data, consistently recover well-resolved and supported groups of Amoebozoa. Our results neither support the monophyly nor dichotomy of 'Discosea' as defined by Smirnov et al. (2011). Rather, we recover a robust well-resolved clade referred to as core-Discosea encompassing the majority of discosean orders (six of the eight studied here), while the Dactylopodida, Thecamoebida and Himatismenida, previously included in 'Discosea,' are non-monophyletic. We also recover novel relationships within the core-Discosea that are largely congruent with morphology. Our analyses enabled us to place some incertae sedis lineages and previously unstable lineages such as Vermistella, Mayorella, Gocevia, and Stereomyxa. We recommend some phylogeny-based taxonomic amendments highlighting the new findings of this study and discuss the evolution of the group based on our current understanding.

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Poster Category: STEM Research

Towards a Predictive Model of Spill-over Events in Zoonotic Disease

Katharina Wollenberg Valero, Bethune-Cookman University
Co-Author(s): Noah E. Douglas, Brianna Johnson, Ayana McGill, Kiara Wootson, Seenith Sivasundaram, and Raphael Isokpehi, Bethune-Cookman University, Daytona Beach, FL

In Fall 2015, ten undergraduate students and three faculty members of Bethune-Cookman University participated in a NSF-sponsored student workshop series about integrating mathematics with quantitative Biology. Two teams of student researchers from Freshman to Senior year belonging to different majors worked on the evaluation of molecular networks, and predictive modeling and dynamics of viral epidemics. The workshop series contributed to the goal of the College of Science, Engineering and Mathematics to achieving academic excellence in Data Analytics (HBCU-UP Targeted Infusion 'QEUBiC' project). This sub-project involved students majoring in Nursing, Biology, and Mathematics. Our goal was to deliver a proof of concept that sporadic spatiotemporal host-switch events in zoonotic diseases with unknown natural hosts can be predicted using eco-environmental data. Ebola Virus disease outbreaks in mammals constitute such a case of sporadic emergence, but the factors leading to spill-over events from natural host to mammal including humans and great apes, are yet unknown. Ebola Virus belongs to the family Filoviridae that has a wide range of natural hosts, and is unstable once outside its host. It is therefore directly linked to properties of its host's ecosystem and its environment. This phenomenon is for example also known from Rabies Virus. We set out to prove that spatiotemporal fluctuations of a set of unrelated eco-environmental variables describing the dynamics of the host ecosystem will be able to accurately predict spillover events. We compiled data of ecological and environmental variables, including rainfall, temperature, climate anomaly, phenology, and animal migration patterns from the literature, together with information on Ebola Virus disease spill-overs. From these we generated data sets showing annual and monthly patterns. We analyzed their predictive power for spill-over events and identified significant predictor variables. Spatial occurrence probability data is available from a recent publication on a Ebola Virus Environmental Niche Model. These variables were used to generate first a graphical model, and lastly, a neural network

model. By visualizing the data set and generating a graphical model, we were already able to pin-point a set of critical biotic and abiotic conditions that might enable cross-taxon spill-over events. We plan to integrate this model to include the spatial predictive GIS data, in order to obtain a spatiotemporal predictive model that can be adapted to other emerging zoonotic diseases.

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Poster Category: STEM Research

Exploring STEM Student Perceptions of HBCU STEM Career Development Activities

Lawrence O. Flowers, Livingstone College
Co-Author(s): Lamont A. Flowers, Clemson University, Clemson, SC

The current research study focused on investigating HBCU student perceptions of pedagogical interventions designed to enhance STEM employment outcomes of HBCU graduates.

Funder Acknowledgement: National Science Foundation (HRD-1505098)

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Poster Category: STEM Science and Mathematics Education

Quantitative Expertise in the Undergraduate Biology Curriculum (QEUBiC) Framework at Bethune-Cookman University

Raphael D. Isokpehi, Bethune-Cookman University, Daytona Beach, FL
Co-Author(s): Katharina Wollenberg Valero, Ahkinyala M. Cobb-Abdullah, Shukdeb Sen, and Elizabeth R. Congdon, Bethune-Cookman University, Daytona Beach, FL

The Quantitative Expertise in the Undergraduate Biology Curriculum (QEUBiC) framework provides an adoptable curriculum framework for infusing key topics in data challenges to biology coursework. Topics in the dimensions of data challenges described by the National Consortium for Data Science as data flow; data analytics and data curation are being infused in the biology curriculum at Bethune-Cookman University (B-CU) through diverse learning experiences. The project is increasing opportunities for students at Bethune-Cookman University to engage in diverse complex cognitive activities such as knowledge discovery, decision making and analytical reasoning from biological data. New questionnaires have been developed to assess learning dimensions, computing use and quantitative capabilities of students. In the QEUBiC framework, evidence-based learning strategies including metacognition and visualization are being implemented to equip students as strategic learners who are able to decide the appropriate learning strategy (strategic learning) to overcome the challenges of discovery and analysis of biological information from multiple sources. Additionally, quantitative reasoning in biology requires students to engage in practices of mathematical thinking (counting, measuring, calculating, graphing, mapping, ordering, problem solving, analysis, hypothesis testing, and, modeling). These pedagogical approaches are being introduced in general education math courses to help better prepare biology students for the upper level data-intensive biology courses. Three research and innovation facilitating courses have been developed through this project: Advanced Computing Resources in Biology; Computational Genomics; and BioMolecular Technologies. BioMolecular Technologies, a junior-level course, will be offered in the Spring 2016 semester and will include learning experiences with advanced instrumentation for biological data generation as well as industry visit to a manufacturer of advanced biological laboratory infrastructure in Volusia County, Florida.

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Poster Category: STEM Science and Mathematics Education

Regenerative Medicine: A Vehicle to Infuse Laboratory-Bench STEM Modules

Chad D. Markert, Department of Exercise Physiology, Winston-Salem State University
Co-Author(s): Breonte S. Guy, Dawn X. Henderson, C. Edward Ebert, and Jill Keith, Winston-Salem State University, Winston-Salem, NC

Although this proposal and the new Department of Exercise Physiology at Winston-Salem State University (WSSU) are two distinct initiatives, both seek to be transformative. Particularly at the graduate level, the discipline of Exercise Physiology is moving towards explaining phenomena by utilizing the same tools used at the laboratory bench in STEM areas such as chemistry, biology, and biophysics. As the discipline, and its charge of training the next generation of Exercise Physiologists, advances in this manner, new Departments of Exercise Physiology at American universities have become stand-alone, distinct from Departments of Physical Education, and have aligned within the penumbra of Medical Schools or Schools of Health Sciences. Accordingly, in July 2014, the Department of Exercise Physiology at WSSU was formed, transitioning away from its former home in the Department of Health, Physical

Education, and Sport Sciences. While that initiative has been accomplished, the work that remains is to improve undergraduate student learning outcomes. Specifically, this will be accomplished by enhancing cognitive and behavioral factors that predict persistence in STEM. The goal of this project is to infuse lab-bench modules into the Exercise Physiology curriculum at WSSU. Activities will include opportunities for further intensive research, and STEM career-focused colloquia. Objective 1: Improve student attitudes toward use of lab bench-based techniques: will be measured using a modified Science Attitude Inventory (SAI III), Moore and Hill Foy, 1998. Objective 2: Improve student perceptions of scientific inquiry in Exercise Physiology: will be measured with Views About Scientific Inquiry Questionnaire (VASI), Lederman J.S. et al, 2014. Objective 3: Increase student intentions to engage in undergraduate research: will be measured with Intended Research Involvement Measure, Deemer E.D. et al, 2014. Objective 4: Increase student intentions to persist in STEM-related fields: will be measured with Career Intention in Science Scale (CIS), Nassar-McMillan S.C. et al, 2012. Novel aspects of this proposal include: offering this experience to undergraduates (the graduate level may be too late); offering this experience using Exercise Physiology as a platform; infusing the lab-bench modules using a bioengineering project as a vehicle; and offering this experience at a HBCU, so that underrepresented students are funneled into STEM graduate schools and careers.

Funder Acknowledgement: NSF HBCU-UP TIP

Chemistry and Chemical Sciences

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Poster Category: STEM Research

Revealing the Structural Basis for Calprotectin-RAGE Signaling Axis

Steven Damo, Fisk University

The receptor for advanced glycation end products (RAGE) is a multiligand receptor that plays a central role in the immune system. RAGE has three extracellular domains, V, C1, and C2, a single helix transmembrane domain, and a short intracellular C-terminus that is largely unstructured. Despite its importance in signal transduction, little is known about the molecular mechanism of RAGE activation. Her hypothesis is that the calcium binding S100 protein family member calprotectin (CP) binds to the extracellular V domain of RAGE which results in in an activated oligomer that is stabilized by the C1 domain of distinct RAGE molecules.

Here we present a multidisciplinary approach combining computational, biophysical and biochemical methods toward understanding the molecular basis of RAGE activation. Computational docking studies of the CP-RAGE (VC1) complex have generated a model that reveals a critical basic and hydrophobic patch of the V domain surface. Mutation of a single residue in this patch lowers the binding affinity of RAGE for CP and related S100 ligands by five fold relative to WT RAGE (VC1). Additionally, using a fluorescence based assay we have demonstrated that the binding affinity of RAGE (V) and RAGE (VC1) for S100 proteins is the same. This suggests that ligand recognition by RAGE occurs only at the V domain. In total, these experiments represent important first steps toward characterizing the molecular mechanism of RAGE activation. Ongoing experiments are focused on characterizing the oligomerization state of various S100-RAGE (VC1) complexes as well as crystallization of the CP-RAGE complex to determine the high resolution structure.

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Poster Category: STEM Research

Variable Temperature Resonance Raman Spectroscopic Studies of MauG

Manliang Feng, Tougaloo College
Co-Author(s): Breland Crudup and Contesa Franklin, Tougaloo College, Tougaloo, MS

MauG is a di-heme protein that catalyzes the posttranslational modification the two endogenous tryptophan residues at the active site of precursor methylamine dehydrogenase (Pre-MADH). It shares sequence and structural homology with di-heme cytochrome c peroxidase (CcP) but the biological role and reaction mechanisms are quite different. Previous X-ray crystallographic , EPR, resonance Raman (RR) and UV-Vis spectroscopic results indicate that the two hemes in MauG are different in coordination and spin states. One heme is pentacoordinated with His35 as the proximal ligand. The other heme is hexacoordinated with His205 and Tyr294 as the proximal and distal ligand. The penta-coordinated high-spin heme is believed to directly react with oxygen donating substrates (H2O2 or O2) to allow the protein to form a bis-Fe(IV) species through charge-resonance among the two hemes and an intervening tryptophan residue.

In this study, RR spectra of MauG were studied at various temperatures (77K, 202K, 232K and 293K) and a temperature dependent structural changes at high spin heme site was observed. At lower temperature, the high spin heme is mainly 5-coordinated while at higher temperature it appears as a mixture of penta/hexa coordinated high-spin heme. The ratio of the 6- to 5- coordinated heme increases with raising temperature. This result implies an equilibrium between the two conformational sub-states (conformers) of MauG, which may play a role in the charge-resonance and fast long range electron transfer of the

protein. RR and Fourier Transformed Infrared (FTIR) spectra of ferrous MauG-CO adduct indicate that the two forms of MauG have discrete conformations as evidence by the 2 vC=O bands. The vFe-CO and vC=O correlations of the two forms point to a conclusion that the proximal linkages of the high-spin heme in one of MauG conformer is stronger than a normal heme with a histidine proximal ligand.

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Poster Category: STEM Research

Interdisciplinary Nanotoxicity CREST Center

Jerzy Leszczynski, Jackson State University

The Interdisciplinary Nanotoxicity Center focuses on the development and execution of novel research projects, educational activities and service to local and scientific communities. The research activities include studies of structures, properties, their applications in various technologically important areas and development of efficient methods for evaluation of toxicity of nanomaterials. Integration of research and education and development of human resources will be one of the main priorities of the Center. All activities will assist further transformation of JSU into a world recognized, highly research active university focusing on education and training of African American students. Currently there are at least 1400 commercial products based on nanomaterials. Understanding of structures, characteristics and biological activities of man-made nanomaterials is critical to prediction of their impacts on the environment and human health. Nanoparticle exposure is common, but short- and long-term exposure effects are currently not fully understood, especially since the primary and agglomerate sizes, surface area, and the characteristics of the surface play such important roles. Conversely, nanotechnology can also be used to create new nanomedicines, sensors, pollutant filters and nanocatalysts with important societal benefits. There is a compelling need of studying potential toxicity of nanomaterials and advancing of efficient, fast and inexpensive computational approaches able to predict toxicity of new species before their industrial applications. The students supported by the Center are involved in training which combines the state-of-the-art experimental and computational techniques applied to nanomaterials. The educational and research activities are strengthen by interaction with the Jackson K-12 school system, The Center is a leader in the area of prediction of toxicity of nanomaterials and one of the largest producer of African American chemistry Ph.Ds. We have established an efficient pipeline for high school African American students from Jackson, MS, that will result in an increased of number of AA undergraduate and graduate students in STEM areas. We believe that in order to involve high school students in research activities and assure their constant interest, the proposed research project should be of general interest and attractive. The research is a driver that also facilitates students' interest in further studying subjects that will help them to understand the details of their activities and analyze obtained results. Among crucial questions that contemporary science asks questions related to intriguing structures and characteristics of nanomaterials are being addressed in the Center. While there is a large group of researchers who investigate phenomena related to the toxicity of nanoparticles using experimental techniques, we developed an alternative approach, based on the background and expertise of various members of the JSU CREST Center. We do carry out such investigations using advanced computational techniques. For the purpose of introducing high school students to highly technical research, such an approach has some significant advantages. The use of computers is quite natural for teenagers - this research tool is already used by them in various everyday activities. There are two annual conference series that have been initiated and executed. For the last twenty three years we have been organizing and securing funding for a series of Conferences on Current Trends in Computational Chemistry (CCTCC). This is supplemented by 15 Southern Schools of Computational Chemistry and Materials Sciences (SSCCMS).

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Poster Category: STEM Research

Infusing Sustainability Concepts in Undergraduate Chemistry Research

Daniela R. Radu, Delaware State University
Co-Author(s): Dominique Powell, Nicholas Pizzi, Lourdjina Cherenfant and Cheng-Yu Lai, Department of Chemistry, Delaware State University

The Targeted Infusion Project in the Department of Chemistry at Delaware State University centers on infusing sustainability in the undergraduate curriculum and integrating sustainability concepts in chemistry-related research projects. Three undergraduate research sub-projects affiliated with ongoing research projects in materials sustainability have been successfully completed to date: A. Application of sustainable materials concepts in solar research; B. Standardized testing methodologies for waste water; and C. Nanoparticles toxicity. The outcome of the research will be presented. Highlights of Sub-Project A. The sustainability approach is reflected at every step of the project, staring from: 1. Materials selection, in the group of abundant, non-toxic reagents and supplies; 2. Establishment of environment-friendly synthetic methodologies; and, ultimately; and 3. Characterization of the products to certify that their properties meet the demand for reduced or

negligible environmental footprint. The materials used in this project are copper-based chalcogenides, formed of Earth abundant metals and sulfur, another ubiquitous element. The metal salts utilized meet the criteria of low toxicity. A process flow is used to determine opportunities to cut on solvent usage and reduce waste. The products are evaluated in tissue culture toxicity testing. All three aspects will be exemplified in the presentation.

Highlights of Sub-Project B. Wastewater analysis is standardized by national and international environmental organizations. In the US, Mid-Atlantic US EPA uses the NELAC standard. The project encompasses evaluation of DSU chemistry capability to conduct wastewater analyses. The project enabled the undergraduate researcher to conceptualize the need of waste water analysis from the sustainability perspective and conduct a detailed evaluation of the components, including instrumentation, analytical methods, standards, and outcomes. The details of the sub-project will be presented. Highlights of Sub-Project C. Provided the large applicability of nanoparticles in consumer products, great societal concerns have been raised. The rapid emergency of nano-based products requires a systematic evaluation of nanoparticles toxicity. In this line, commercially available as well as in-house made ZnO and TiO2 nanoparticles have been subjected to toxicity testing in mammalian cells. The results of this research will be presented.

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Poster Category: STEM Research

Effect of Basis Set Size on the Quality of the Molecular Electrostatic Potential

Kevin E. Riley, Xavier University of Louisiana
Co-Author(s): Khanh-An Tran

The electrostatic potential is a very useful molecular property that can be used to predict such things as chemical reactivity and participation in noncovalent interactions. The electrostatic potential can be determined experimentally, but is much more commonly obtained using computational chemistry techniques. Most often medium basis sets, such as 6-31G* are used to compute this property, but sometimes smaller basis sets, such as STO-3G and 3-21G, are used. To date, studies seeking to clarify the role that the basis set plays in the quality of the electrostatic potential have not been carried out. Here we generate electrostatic potentials for three molecules, HCN, BrCN, and H3CCH, using a large number of basis sets, ranging in size from STO-3G to aug-cc-pVTZ, along with the Hartree-Fock and DFT (B3LYP and M06-2X) methods. It is found that basis sets at least as large as 3-21G* must be used in order to consistently generate reasonably accurate electrostatic potentials.

Funder Acknowledgement: NSF HBCU UP (Grant # 1505219).

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Poster Category: STEM Science and Mathematics Education

Use of a Flipped Learning Pedagogy in the General Chemistry Sequence

Lisa Hibbard, Spelman College
Co-Author(s): Shannon Sung, Education Studies Program, Spelman College

Use of the flipped learning format in the teaching of general chemistry has become more prevalent in recent years. This pedagogy maximizes learning by shifting content delivery online which then allows for face-to-face classroom sessions to focus on student-centered active learning. This cross-sectional study assessed student performance in a college-level general chemistry sequence taught using the flipped learning format as compared to a more traditional lecture format. Student knowledge of chemistry concepts was assessed through the use of American Chemical Society standardized exam scores and analyzed using the one-way ANCOVA statistical software. Student motivation and learning perceptions were evaluated through the use of a Chemistry Motivation Questionnaire (CMQ-II) and an in-house learning survey. Analysis of the data acquired over a five-year period from courses taught by the same instructor indicated that students who attended those courses taught using the flipped learning format performed better on the standardized exams than those in the traditional lecture courses. Student perceptions regarding the new lecture format were mostly positive and reflected a positive impact on student motivation and course performance.

Funder Acknowledgement: NSF Targeted Infusion Grant #1332575; HHMI Undergraduate Education Program Grant #52007559

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Poster Category: STEM Science and Mathematics Education

Fostering STEM Mastery with Case studies in Developmental Mathematics, Supplementary Instruction in Gatekeeper Courses, and Course-Embedded Research

Qingxia Li, Fisk University
Co-Author(s): Natalie Arnett, Tiffany Thompson, Brian Nelms, Phyllis Freeman, Princilla Evans Morris, and Lee E. Limbird, Fisk University, Nashville TN

The goal of our HBCU-UP Implementation Award is to increase student engagement, deeper learning, and retention in STEM majors at Fisk University. Since mathematics preparedness can delay students' access to upper level STEM courses, we focused

on student-centered pedagogies in developmental math, specifically case-based studies, to increase academic performance. Case-based interventions significantly improved student learning, based on pre-versus post-tests. Current work will determine if this intervention success holds when extended to additional faculty instructors in the discipline. Similarly, Supplementary Instruction in General Chemistry I and II also signficantly increased student grades for a second year of study, while also fostering continuation from Chem I to II. Embedding research into a Molecular Methods Course in Biology was complemented with ' flipped classroom' pedagogies, leading to increased student participation in faculty-mentored research. Similarly, embedded research in an introductory Genetics course led to student pursuit of faculty-mentored research. Adoption of a focus on student-centered teaching strategies by Fisk's Center for Teaching and Learning is institutionalizing lessons learned across the disciplines.

Funder Acknowledgement: NSF HBCU-UP Implementation Award at Fisk University

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Poster Category: STEM Science and Mathematics Education

Community-based Interactive Engagement in an Organic Chemistry Course

Leyte Winfield, Spelman College

A community-based element was merged with an interactive engagement learning environment in the organic chemistry course. The learning community was established by requiring chemistry and biochemistry majors to enroll in the same section of general chemistry and subsequently organic chemistry (courses designated as majors only). This allowed freshmen entering the major in a given year to matriculate through the first four semesters in a structured learning community. For the organic chemistry course, the cohort was comprised of 25 to 30 students with less than 5 of these students being from majors outside of chemistry and biochemistry. The majors only organic chemistry course infuses inquiry-based and computational exercises into a flipped learning format. It was envisioned that such a learning environment would enhance students' cognitive ability and confidence in utilizing chemical concepts. The course highlights an integrated peer learning structure with mediated learning strategies that extend beyond the classroom through question and answer blogs and online office hours. In this way, the course design takes advantage of the Community of Inquiry Framework.

Guiding questions for the evaluation of this learning environment where:

1) How do students actively engage in learning during and beyond the lecture period,
2) How do students conceptualize chemical knowledge, and
3) What is the impact of the learning environment on students' ability to master concepts?

The presentation will provide an overview of course activities. In addition, it will highlight the learning behaviors and outcomes of the two cohorts in the first semester organic chemistry course and the activities which students found most beneficial as a correlation to grade outcome.

Funder Acknowledgement: This investigation has been funded in part by a grant from the National Science Foundation HBCU-Up Targeted Infusion Project Award No. HRD-1332575.

Computer Sciences and Information Management

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Poster Category: STEM Research

Computational Research on Music & Audio (CRoMA): Year One Review

David Heise, Lincoln University

Computational Research on Music & Audio (CRoMA) was launched at Lincoln University in 2015 with the support of the National Science Foundation through an HBCU-UP award. The purpose of this project is to establish a research program to study aspects and applications of computational audio signal processing. This effort has an interdisciplinary focus, drawing from disciplines such as computer science, engineering, mathematics, psychology, and music. Further, the project aims to specifically include undergraduate students in the research activities. In year one, the project has: a) directly supported four undergraduate students as research assistants; b) supported summer research for the PI at the Center for Interdisciplinary Research on Music, Media & Technology (CIRMMT, housed at McGill University), leading to new research collaborations and focus; c) enabled presentation of work by students and the PI at regional and international conferences; d) spurred development of a new course that enhances the computer science curriculum and prepares undergraduate students for this research; and e) supported a one-day symposium on CRoMA, bringing together faculty and students from multiple institutions and providing an opportunity for undergraduates to present their research.

Funder Acknowledgement: National Science Foundation, Award #1410586

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Poster Category: STEM Research

Mobile Response System: Making Class Engagement Interactive

Mohammad M. Fuad, Winston-Salem State University
Co-Author(s): Debzani Deb and James Etim, Winston-Salem State University, NC

To improve student's class experience, the use of mobile devices has been steadily increasing. However, such use of mobile learning environments in the class is mostly static in nature through content delivery or traditional quiz taking. In STEM courses, we need learning environments where students can interact with the problem and faculty can assess their learning skills in real-time with problems having different degree of difficulty. To facilitate such interactive problem solving using mobile devices, a comprehensive backend system is necessary. In that regard, a Mobile Response System (MRS) software is developed, which provides faculty with the opportunity of evidence-based teaching by allowing students with interactive exercises with different learning outcomes and by getting an instant feedback on their performance and mental models. MRS is domain independent, easy-to-use, and can render interactive exercise developed by third party developer. The incorporation of MRS in the classroom reveals promising results and trends.

Funder Acknowledgement: This research was supported by National Science Foundation grant #1332531.

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Poster Category: STEM Research

Design of Intelligent Technologies for Smartgrids

Enrico Pontelli, New Mexico State University
Co-Author(s): Satish Ranade, New Mexico State University, Las Cruces, NM

The goal of the interdisciplinary Center of Research Excellence in Design of Intelligent Technologies for Smartgrids (iCREDITS) is to provide a new epicenter for research and training in smartgrids. The need for an evolution in current electric grids has been long recognized. Today's power-delivery paradigm is centralized; the requirement of providing instantaneous power on request leads to a rigid management structure, with the installation of excessive, expensive and unsustainable electricity generation capacity. The vision of iCREDITS is to obtain sustainable generation capacity by shifting the paradigm from power delivery to energy delivery, using smartgrid concepts. In an energy delivery system, energy is viewed as a commodity, which can be produced, stored, and exchanged. Producers and consumers establish continuous negotiations, where, e.g., producers provide prices of energy and consumers provide energy profiles, until they reach agreements on scheduled deliveries of blocks of energy over specific time periods; in these scenarios, customers can themselves enter in energy exchanges. This paradigm will lead to better economic sustainability due to more efficient generation, transmission and usage. This vision accommodates the creation of small 'microgrids,' larger 'customer-driven microgrids' in a distribution feeder and, ultimately, the 'smartgrid,' which includes the generation, transmission, and distribution of the entire power system. While there is agreement that the energy delivery model will enable the smartgrid vision, there are profound challenges to its realization. The research focus of iCREDITS is to develop the fundamental science and engineering necessary for the energy delivery paradigm. The realization of the smartgrid vision requires solving a second fundamental problem: the dramatic shortage of smartgrids workforce, exacerbated by the lack of diversity in gender, ethnicity and cultural backgrounds. iCREDITS builds on five objectives: (C) Create a Center infrastructure to enable interdisciplinary research and training in smartgrids, (R) Develop a research agenda to realize the energy delivery paradigm and sustain the design and development of smartgrids, (E) Develop a comprehensive interdisciplinary training pipeline in smartgrids, (D) Develop an agenda to promote participation of a diverse student population in smartgrids training and research, (S) Achieve international leadership in smartgrids research and training.

Funder Acknowledgement: National Science Foundation, HRD-1345232

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Poster Category: STEM Research

Multiscale Drug Effects Modeling using Applied Systems Pharmacology

Lijun Qian, Prairie View A&M University
Co-Author(s): Xiangfang (Lindsey) Li, Prairie View A&M University

Although there have been extensive studies on multiscale modeling of cancer from molecular level to tumor level in the past decade, drug effect modeling has mostly remained at the pharmacokinetics/pharmacodynamics (PK/PD) characterization in modern pharmacotherapy without any multiscale consideration and integration with existing multiscale tumor studies. Thus, there is a need to develop multiscale computational models which cover the divide between organism-level PK/PD model and cell-level biochemical models. In this study, a stochastic hybrid systems model that links the drug efficacy obtained at the cell population level to pathways of interest at the molecular level is proposed and investigated. A

simulation study of the proposed model for colon cancer cell line HCT-116 with drug Lapatinib input is carried out and compared with the results from the wet-lab experiments at TGen. The observation is that Lapatinib repressed the cancer cells from proliferating and there exist a slow start for the first 10-15 hours then a linear segment, and later after 30 hours a saturation in response as equally observed in the experiments at TGen. It is demonstrated the proposed model in silico has potential to aid progress towards integrative personalized medicine, in which we can administer optimal patient-specific nutritional or therapeutic regimen based on the patient's profiles and drug effects.

Funder Acknowledgement: NSF 1238918

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Poster Category: STEM Research

Game Theme-Based Instructional (GTI) Modules for Introductory Programming

Sharad Sharma, Bowie State University
Co-Author(s): James Stigall, Emmanuel Ossuetta, and Jeff Ruffin

Due to a gradual decrease in computer science students, in spite of a growing demand for computer science professionals, it is crucial to find a way to attract computer science students by making the concepts even more fascinating and absorbing. This research focuses on the development of a Game Theme-based Instructional (GTI) modules for computer science students that motivates and engages students while contributing to their learning outcomes. We have developed and evaluated three GTI modules for teaching loops, arrays, and object oriented programming. The GTI modules add more inquiry based problem-solving activities and hand-on experiences based on Gaming and Virtual Reality. GTI modules are designed to encourage faculty to teach and motivate students to learn the concepts of object oriented programming using interactive, graphical, game-like examples. The instructional modules act as a supplement to an existing course and enable faculty to explore teaching with a game-theme materials and helping students to be more motivated and engaged in class. We have evaluated the GTI modules in a CS1 and CS2 in multiple semesters at Bowie State University for Computer Science major students. Survey data demonstrates that the module makes a significant educational impact on student learning concepts. The results of the evaluation of GTI modules also demonstrate the effectiveness of the instructional module and the possibility to include it in the existing curriculum with minimum alterations to the existing established course material.

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Poster Category: STEM Science and Mathematics Education

Interactive Data-mining of Spectroscopic Data

Gary Holness, Optical Science Center for Applied Research, Delaware State University
Co-Author(s): David Pokrajac, Tomasz Smolinski, Sokratis Makrogiannis, and Jinjie Liu, Optical Science Center for Applied Research, Delaware State University

Spectral methods based on laser scattering and spin polarization present new challenges to the identification of bio-macro molecules. Our contributions to recognition of pattern phenomena from bio molecules from their spectra include a model for optimal classifier design based on statistical detection theory, simulations of nonlinear Maxwell scattering using Finite Difference Time Domain (FDTD) methods, non-linear heat diffusion equation models for spatio-temporal cell segmentation from time lapse image sequences, a new information theoretic method called Chisini Jensen Shannon divergences and a new kernel that achieves superior results in Support Vector Machine classification. For cell segmentation, moving regions are initially detected in each set of three consecutive sequence images by numerically solving a system of coupled spatio-temporal partial differential equations and determining the optimal values for the temporal and spatial diffusion parameters. After the spatio-temporal diffusion stage is completed, we compute the edge map. This process is followed by watershed-based segmentation to detect the moving cells. We applied this method on several datasets of fluorescence microscopy images. We validated all segmentation techniques against reference masks provided by the international Cell Tracking Challenge consortium. Our proposed method produced encouraging segmentation accuracy, especially when applied to images containing cells undergoing mitosis and low SNR. The proposed technique yielded average improvements of 7% in segmentation accuracy compared to both strictly spatial and temporally linked Chan-Vese techniques. Using the apparatus of statistical theory of detection, we develop the optimal classifier for spectroscopy data for a linear model of an echelle spectrograph system. We validate model assumptions through statistical analysis of 'dark signal' and laser-breakdown induced spectra of standardized NIST glass. The experimental results suggest that the quadratic classifier may provide optimal performance if the spectroscopy signal and noise can be considered Gaussian. We perform multi-class classification of laser-Induced breakdown spectroscopy data for four commercial samples of proteins: bovine serum albumin, osteopontin, leptin, and insulin-like growth factor II. We achieve classification accuracies above 98% by using the linear classifier with 21-31 principal components.

Funder Acknowledgement: This work was supported by National Science Foundation CREST grant - HRD-1242067.

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Poster Category: STEM Science and Mathematics Education

TIP: Transforming Computer Science Education using 'upside down' Curriculum, Course-embedded Projects, Integration with other STEM Disciplines

Sajid Hussain, Fisk University
Co-Author(s): Sajid Hussain, Steven Morgan, and Zia Haque

This TIP Award to Fisk University includes a four-objective plan to innovate the curriculum and the pedagogies for teaching and learning of computer science (CS) in order to create awareness, interest and success in CS as a discipline.

The four objectives are as follows:

1. Computational Thinking in CS courses for non-majors: Modify the CS curriculum for non-majors by revising the introductory CS course (CS 100; 3hr credit) to include computational thinking, and add two one-credit hour courses on Mobile Apps and on Web Apps.
2. Appealing Tools in Introductory Courses: Introduce CS tools perceived as 'relevant' by students in introductory CS courses on the major pathway (specifically CS 110/120/241) and foster use of these tools in course-embedded student-engaged projects and faculty-student mentored summer research projects.
3. Computing in Cognate Courses: Introduce computational programming in cognate courses required for CS majors, namely mathematics and physics, in order to sustain the impact of computational thinking across the curriculum.
4. Peer Mentors (PM): Utilize peer mentoring/coaching to foster deeper learning of CS in CSCI 110/120/241, as well as in cognate courses, such as Math 101/110/120 and Physics 130/140, and to serve as 'coaches' in course-assigned projects.

Funder Acknowledgement: NSF: HBCU-UP/TIP: Award Abstract #1332432

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Poster Category: STEM Science and Mathematics Education

The Introduction of NSF CREST Center for Research on Complex Networks at Texas Southern University

Wei Wayne Li, Texas Southern University

The new Center's multiple disciplinary team comprises a total of 14 world-class faculty scholars representing 6 different departments in the College of Science and Technology, including Departments of Computer Science, Transportation Studies, Physics, Engineering Technology, Mathematics, and Chemistry. The funded Center will have a great impact on students at TSU by financially supporting a minimum of 15 undergraduate and graduate students each year in the next five years, providing them the opportunity to work with faculty on the cutting-edge research and development. The mission of this NSF Center is to conduct innovative and multidisciplinary research in the area of complex networks, which will provide a knowledge base for the understanding of complex networks, i.e. energy efficient wireless sensor networks, urban transportation environmental networks, and distributed computational networks, allowing for the development and implementation of policies for global environmental sustainability. The research will be integrated with the science, technology, engineering and mathematics (STEM) education programs, particularly striving to expand the pool of minority and underrepresented students who pursue advanced graduate studies in STEM fields, to meet the critical workforce needs of the nation. The Center will promote and implement diversity in STEM disciplines, through educational outreach initiatives and extensive effort to recruit, retain and train members of underrepresented minority groups. The attempt is to prepare minority students for leadership positions in the fast-changing global, scientific, engineering, and government sectors.

Funder Acknowledgement: National Science Foundation Grant # HRD-1137732.

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Poster Category: STEM Science and Mathematics Education

Graduation Academy - Transitioning STEM Students to Graduation and Graduate School

Larry Mattix, Norfolk State University
Co-Author(s): Valencia Ingram and Patrice Smith, Norfolk State University, Norfolk, VA

Despite gains in freshmen retention (now 77 percent) at Norfolk State University (NSU) and the number of STEM Graduates (57% increase, from 2001 to 2012), the increase in the six-year STEM graduation rate has been very modest and still hovers around 30 percent. The positive news for NSU is that the students who complete our STEM programs are very successful. They are frequently recognized through their presentations at national research competitions and post NSU students are earning graduate and professional degrees from some of the nation's premier institutions of higher education. In the past, we have focused on freshmen to sophomore retention with our previous NSF (STARS/STARS-Plus) grant. We have assumed the traditional model with the first year called freshmen, the second called sophomore, third called junior and fourth called senior. When the first STARS program started in 2001, the STEM freshman cohort retention rate was 68%. However, only 19% of the STEM freshmen cohort was categorized as sophomores by the second fall. Therefore, the College of Science, Engineering,

and Technology at NSU has established a new project, entitled: 'Graduation Academy: Transitioning STEM Students to Graduation and Graduate School.' This new project focuses on the development of STEM majors at the sophomore, junior, and senior levels, building upon the great success of other STEM programs at NSU. The new project features the following: (1) A Graduation Academy (which focuses on moving the students toward graduation and then on to graduate school); (2) A new concept of a Sophomore Summer Bridge Program; (3) Departmental Junior Prep and Grad Societies for enhanced advising and mentoring of students at the sophomore, junior, and senior levels; (4) Transition weeks to lead juniors and seniors toward completion; (5) An existing Community College component (T-CUP) that focuses on juniors who transfer to NSU; (6) Scholarships and undergraduate research support; and (7) Faculty development to foster improvements in student performance in junior and senior courses. The new project encourages and support the participation of students from underrepresented groups in scientific meetings and activities of professional societies. A cascading mentoring component between undergraduate students, graduate students, and faculty provides the interactions and community to help ensure successful outcomes.

Long Term Goals:

- To increase the matriculation rate of students from sophomore to junior by the third fall
- To increase in the number of students maintaining eligibility for Federal Financial Aid
- To increase the success-rate of students beyond the freshmen year
- To improve the freshmen STEM retention rate to 85% and the six-year graduation rate to 50%
- To increase the number of transfer students completing STEM degrees
- To increase in the diversity of the workforce in STEM fields

Project Objectives:

- To develop a STEM Graduation Academy to support sophomore, junior, and senior STEM majors toward graduation
- To improve faculty teaching and student learning in STEM, particularly for sophomore and junior
- To enhance the STARS Mentoring Center to support sophomore, junior, and senior STEM majors
- To build-upon the T-CUP model (supported by NSF) in Engineering and provide the same support to students transferring in as juniors
- To use a cascading mentoring model to enhance the success and maturity of both undergraduates and graduate students.

Funder Acknowledgement: National Science Foundation

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Poster Category: STEM Science and Mathematics Education

Integrating Mobile Computing and Security into a Computer Science Curriculum

Xiaohong Yuan, North Carolina Agricultural and Technical State University

The poster describes our project of integrating mobile computing and security into the Computer Science program at North Carolina A&T State University. Twelve (12) course modules in mobile computing and security are being developed and integrated into existing Computer Science courses such as computer programming, software development, operating systems, and information assurance courses. Each course module includes learning objectives, a tutorial, presentation slides, hands-on labs and/or case studies, test questions, etc. The course module material we develop and our teaching experiences will be beneficial to computer science educators who are considering including mobile computing and mobile security into their curricula.

Funder Acknowledgement: National Science Foundation (NSF) under the award HRD-1332504

Ecology, Environmental and Earth Sciences

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Poster Category: STEM Research

Modeling Mercury Flow Dynamics and Bioaccumulation along East Fork Poplar Creek (EFPC)

Maruthi Sridhar Balaji Bhaskar, Texas Southern University
Co-Author(s): Mark Bevelhimer and Mark Peterson

Monitoring of mercury (Hg) accumulation in fish has been conducted in East Fork Poplar Creek (EFPC) in Oak Ridge, Tennessee since 1985 under the Biological Monitoring and Abatement Program (BMAP). The bioaccumulation of Hg in EFPC fish has proven to be enigmatic over the past several years, with remedial actions at the industrial facility in the creek's headwaters successfully decreasing total Hg concentrations in water, but not resulting in commensurate decrease in fish Hg concentrations.

The primary goal of this project was to develop a model to understand the Hg loading and distribution in the EFPC watershed. Specific objectives of the project includes: 1) modeling the transport and fate of Hg through the 20 km stretch

of EFPC; 2) to simulate and analyze the Hg loading from different sources; and 3) to evaluate the outcomes of different possible future scenarios in the region. A simulation model using STELLA™ was developed using an object-oriented modeling environment to simulate and analyze the Hg loading, distribution and bioaccumulation patterns in the EFPC. The model comprises of five interactive sectors namely: Water flow, Total Suspended Solids, Total Mercury, Methyl Mercury and Fish bioaccumulation. These sectors are interlinked and changes in one sector will impact other sectors through feedback loops between sectors. Key parameters in the model include erosion, mercury dissolution, methylation factor, and bioaccumulation factor. The STELLA model results showed that in general, the Hg bioaccumulation increased in downstream reaches of EFPC. The rate of Hg bioaccumulation depended not only on the erosion and water flow but also on the rate of Hg dissolution, methylation and bioaccumulation factors. The model was calibrated to match field results so that alternative situations could be simulated in future. This study suggests that the model, developed with STELLA, is a useful tool for estimating Hg dynamics in EFPC.

Funder Acknowledgement: This work was supported in part by the U.S. Department of Energy, Office of Science, Office of Workforce Development for Teachers and Scientists (WDTS) under the Visiting Faculty Program (VFP) and by the National Science Foundation (NSF) under the award.

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Poster Category: STEM Research

Forest Disturbance Long-term Impacts on Amphibian Populations Genetic Diversity, William B. Bankhead National Forest

Rashidah Farid, Alabama A&M University
Co-Author(s): Khairy M. Soliman and Yong Wang, Alabama A&M University

Populations of many amphibian species have declined because of habitat destruction, fragmentation, and alteration. In a forest community that has experienced dynamic changes in habitat structure and composition, it is expected that amphibian populations' genetic variations could be affected due to declined success of breeding and survivorship, which might lead to the bottleneck effect over multiple generations. A study was initiated at Bankhead National Forest in Alabama to examine how past forest management practices have affected genetic structures of pool-breeding amphibian species.

Molecular markers simple sequence repeats (SSR) were used to assess the level of heterozygosity among and within individual populations and species in the area of study. Five vernal pools of different size and disturbance history were selected and tissue samples were collected from two targeted species: Ambystoma maculatum and Notophthalmus viridescens viridescens. Heterozygosity of Ambystoma maculatum populations ranges from 35-55%, with inbreed coefficient not exceeding 55%. However, homozygosity was highly prevalent in all Notophthalmus viridescens viridescens populations. All three populations of Eastern Red Newt exhibited bottleneck events; allele frequency (0-0.22) was lowest in the first distribution class. Two populations of Spotted Salamander exhibited bottleneck events; allele frequencies were 0 and 0.21. The results provided a glimpse into the landscape's genetic connectivity and created a baseline for future genetic monitoring studies of these species. KEY WORDS: salamanders, gene drift, habitat fragmentation, bottleneck

Funder Acknowledgement: NSF

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Poster Category: STEM Research

Real-time Atmospheric PM Monitoring Using a Portable Sensor

Hyun-Min Hwang, Texas Southern University
Co-Author(s): Allen White, Texas Southern University, Houston, TX

Fine atmospheric particulate matter (PM2.5), which is produced from combustion of organic matter (e.g., fossil fuels and wood) and some industrial processes, can reach deep parts of lungs and reside longer than bigger particulate matter. After the implementation of Clean Air Act, PM2.5 concentrations in the ambient air have declined substantially. However, some areas in some communities in downtown or near point sources such as refineries, cargo train stations in Houston may ambient air quality standard significantly. Current stationary air monitoring system may not be able to represent these small scale problems. Portable PM sensors can be used as screening tools to find problematic areas that need further investigation. Atmospheric PM2.5 concentrations were measured at various sites using a portable aerosol monitor (Dust Track DRX 8533EP). Daytime PM2.5 concentrations exceeded the standard frequently at a downtown site near a heavy traffic road and in areas near metal recycling facility, cargo train station, and refineries. This study indicates that utilization of a portable sensor can be an effective real-time atmospheric PM monitoring in areas that cannot be covered by stationary monitoring network.

Funder Acknowledgement: NSF HBCU-UP RISE (1345173)

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Poster Category: STEM Research

CSUB NSF CREST Research on Climate Change and the San Joaquin Valley, CA

William Krugh, California State University, Bakersfield
Co-Author(s): Graham Andrews, Dirk Baron, Christine Cruz-Boone, Janice Gillespie, Junhua Guo, Robert Horton, Eduardo Montoya, and Robert Negrini, California State University, Bakersfield

As part of the NSF-supported Centers for Excellence in Science and Technology (CREST), student and faculty researchers at California State University, Bakersfield (CSUB) have been investigating the regional impacts of climate change as well as evaluating the potential of local contributions to its abatement. Highlights of this research include: 1) the development of a high -resolution climate record from Tulare Lake sediments that spans the past 20,000 years; 2) the quantitative analysis and prediction of climate change impacts on Sierra Nevada snowpack; 3) the detailed subsurface characterization of San Joaquin Valley oilfields targeted for CO2 sequestration; and 4) the evaluation of proposed host rock suitability under simulated CO2 injection conditions. To date, CSUB CREST supported research has resulted in 26 contributions to peer-reviewed journals (currently published or in-review). A primary goal of CSUB CREST is to improve the recruitment, retention, and success of students from the local community, the majority of whom are from backgrounds under-represented in STEM disciplines. More than 28 students have been directly involved in the basic and applied research projects supported by this program. The majority of these students have received, or are on track to receive, an M.S. degree and have ultimately gained employment in a STEM field or been accepted into a Ph.D. program. This presentation will focus on the accomplishments, challenges, and strategies for success gleaned from CSUB CREST Phase 1.

Funder Acknowledgement: NSF CREST 1137774

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Poster Category: STEM Research

Environmental Stress in the Gulf of Mexico and its Potential Health Impact

Bernard Singleton, Dillard University
Co-Author(s): Christian Thomas, Mark Hernandez, Jane Turner, Lewins Walter, Nichole Lathan, Donique Thorpe, Paula Ogbevoen, Joshua Daye, DeShae Alcorn, Sean Wilson, Joy Semien,Tequila Richard,Terry Johnson, Kevin McCabe, John J. Estrada, Fernando Galvez, Cruz Velasco, and Krzysztof Reiss

The British Petroleum oil Deep Water spill in the Gulf of Mexico wasthe largest maritime oil spill in history resulting in the accumulation of genotoxic substances in the air, soil, and water. This has potential far-reaching health impacts on cleanup field workers and on the populations living in the contaminated coastal areas. We have employed portable airborne particulate matter samplers (SKC Biosampler Impinger) and a genetically engineered bacterial reporter system (umuC Assay) from EBPI) to determine levels of genotoxicity of air samples collected from highly contaminated areas of coastal Louisiana including Grand Isle, Port Fourchon, and Elmer's Island in the spring, summer and fall of 2011, 2012, 2013 and 2014. Air samples collected from a non-contaminated area, Sea Rim State Park, Texas, served as a control for background airborne genotoxic particles. In comparison to controls, air samples from the contaminated areas demonstrated highly significant increases in genotoxicity with the highest values registered during the month of July in 2011, 2013, and 2014, in all three locations. This seasonal trend was disrupted in 2012, when the highest genotoxicity values were detected in October, which correlated with hurricane Isaac landfall in late August of 2012, about five weeks before a routine collection of fall air samples.

Our data demonstrate: (i) high levels of air genotoxicity in the monitored areas over last four years post DWH oil spill; (ii) airborne particulate genotoxicity peaks in summers and correlates with high temperatures and high humidity; and (iii) this seasonal trend was disrupted by the hurricane Isaac landfall, which further supports the concept of a continuous negative impact of the oil spill in this region.

Funder Acknowledgement: National Science Foundation-NSF HRD-1118254.

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Poster Category: STEM Research

Ten Years of Long-Term Ecological Research on the William B. Bankhead National Forest, Alabama

Yong Wang, Alabama A&M University
Co-Author(s): Callie Schweitzer, USDA Forest Service - Southern Research Station, Huntsville, AL
Zachary Senwo and Wubishet Tadesse, Alabama A&M University

The Center for Forest Ecosystem Assessment (CFEA) team at Alabama A&M University (AAMU) and the USDA Forest Service's Southern Research Station have been collaborating for over ten years on the Cumberland Plateau, primarily in the William B. Bankhead National Forest (BNF) in northwestern Alabama. The main research focus has been to determine the most effective means by which to convert an unmanaged loblolly pine forest (~50 years) vulnerable to Southern Pine Beetle (Dendroctonus frontalis) infestations, to a mixed upland hardwood-pine forest, with an emphasis on oak restoration. In 2004, a two-factor

randomized complete block design was established in the BNF, with four blocks (~9ha) and nine treatments of varying combinations of thinning and prescribed burning. Apart from the controlled treatments, thinning was either heavy (to ~11m2 basal area) or light (to ~17m2 basal area), and burns have taken place either every 3 or 9 years. The Center is comprised of three sub-projects, with the goal of examining a variety of physical and ecological responses to the combined burning/thinning treatments: (SP1) Forest community responses and dynamics (FC), which examines the ecological and genetic responses of forest macrobiota; (SP2) Forest ecosystem function and processes (FE), which examines the responses of soil chemicals and microbial fauna; and (SP3) Coupled dynamics of humans and landscapes (CD), which examines the ecological and anthropogenic implications of forest management at a landscape level. For many research projects, pre-treatment data has been taken. Thus, flora, fauna, soil, and watershed-level data were recorded prior and (often) just after thinning and each burn cycle. Thus far, 19 faculty researchers, 8 PhD students, and 20 MS students have worked on research directly affiliated with the long-term BNF thinning/burning hardwood restoration project and have published 21 peer-reviewed papers, to date.

Funder Acknowledgement: National Science Foundation's CREST Program Alabama EPSCoR Graduate Research Scholars Program Environmental Protection Agency's STAR Graduate Research Fellowship Program Alabama Department of Conservation and Natural Resources USDA National Institute of Food and Agriculture.

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Poster Category: STEM Research

Exploring the Possibility of Using MODIS AOD Data for PM2.5 Monitoring

Zhiming Yang, North Carolina Central University

Traditional station-based PM2.5 monitoring is costly and has limited spatial coverage. Satellite-based remote sensing could serve as an alternative because of large spatial coverage and reliable repeated measurements. While some studies have shown the high potential of utilizing MODIS Aerosol Optical Depth (AOD) data in PM2.5 monitoring at regional scale, poor MODIS AOD-ground PM2.5 relationships were still reported in some parts of United States.

The purpose of this study is to examine the correlation between MODIS AOD (3km) and ground-level PM2.5 in the state of North Carolina in order to develop a cost-effective method to measure PM2.5 using satellite-based remote sensing. In this study, hourly PM2.5 data for all Airnow stations in NC and MODIS AOD data were acquired from Airnow network and USGS web site respectively for the year 2011 and 2012. Their spatial correlations were examined at different levels: daily, monthly and seasonally. Our preliminary analysis suggested that there is no consistent statistically significant relationship between MODIS AOD value and ground mass concentration of PM2.5 in NC for 2011 and 2012. The poor correlation presents a significant challenge for air quality monitoring using remote sensing techniques in the state of North Carolina.

Funder Acknowledgement: HBCU-UP program

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Poster Category: STEM Science and Mathematics Education

Impact of Targeted Infusion Project Funding on Equipment Infrastructure at Bethune-Cookman University

Raphael D. Isokpehi, Bethune-Cookman University, Daytona Beach, FL
Co-Author(s): Katharina Wollenberg Valero, Tia Rusciano, Ahkinyala M. Cobb-Abdullah, Yungkul Kim, Irving Robinson, Christopher Davis, Shukdeb Sen, Elizabeth R. Congdon and Herbert Thompson, Bethune-Cookman University, Daytona Beach, FL

In August 2014, Bethune-Cookman University, a private HBCU in Florida, received a $400,000 award from the National Science Foundation for a Targeted Infusion Project titled: "Developing Quantitative Expertise in the Undergraduate Biology Curriculum (QEUBiC)." The project has led to the establishment of a Genomics Facility and a Research and Innovation Hub in the College of Science, Engineering and Mathematics of Bethune-Cookman University. Digital data generating instrumentation purchased include bio-imaging systems, spectro-photometers, sensors, microscopes and a DNA desktop sequencer. A 70" Class Interactive Display System and Interactive Projector were new equipment acquired for interactive data visualization. Additional instrumentation to support Science, Technology, Engineering and Mathematics (STEM) research and teaching were also purchased by the administration of Bethune-Cookman University. In conclusion, this set of instrumentation is relevant to developing learning experiences on biological discovery and analysis for undergraduate students.

Funder Acknowledgement: National Science Foundation HRD-1435186.

Mathematics and Statistics

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Poster Category: STEM Research

Mathematical Assessment of Methamphetamine Abuse in a Specific Population

Aprillya Lanz, Norfolk State University
Co-Author(s): A. B. Gummel, Arizona State University

Methamphetamine is an addictive stimulant that releases high levels of neurotransmitter dopamine. The use of methamphetamine has shown to increase libido and reduces inhibition. As a result, methamphetamine is commonly used among men who have sex with men to initiate, enhance, and prolong sexual encounters. This, in turns, promotes high risk sexual behavior in this community of methamphetamine users which increases the risk of acquiring an STD. Furthermore, studies have shown that the use of methamphetamine is associated with more frequent risky sexual behaviors among HIV positive men when compared with HIV negative men. In this poster, we will present a compartmental model that represents the dynamics of methamphetamine abuse and HIV transmission in the men seeking men community from a mathematical perspective. The model considers different stages of progression of meth use and individuals who are temporary or permanently quitters. The analysis of the model reveals that the meth-free equilibrium is globally-asymptotically stable whenever the meth -generation number, a threshold value, is less than unity, and unstable if this value is greater than unity. Simulations of the model using a reasonable set of parameter values will be presented to represent different possible scenarios.

Funder Acknowledgement: NSF HBCU-UP Grant No. 1505498

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Poster Category: STEM Science and Mathematics Education

Targeted Infusion of an Undergraduate Bio-Track Program in Fisk University

Sanjukta Hota, Fisk University
Co-Author(s): Lei Qian and Brian Nelms, Fisk University, Nashville TN

With the funding from NSF HBCU-UP-Targeted Infusion Project (2013-2016), an undergraduate interdisciplinary program in Biomathematics and Bioinformatics has been developed in Fisk University to enhance and expand undergraduate STEM education and research at the interface of mathematics, biology and computer science. The strategy used to achieve the goal includes: (1) development and implementation of three new undergraduate courses: Biomathematics I and II and Bioinformatics; and creating a new emphasis area within the existing undergraduate STEM curriculum at Fisk University; and (2) offering stipended summer research opportunity to six students (sophomore and junior) for eight weeks in Biomathematics and Bioinformatics, mentored by program faculty members. The presentation poster will display the major activities and accomplishments of this project, the challenges faced, the program's impact on the students and on the institution and the expected outcome.

Funder Acknowledgement: HBCU-UP

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Poster Category: STEM Science and Mathematics Education

Mathematics Behind The Science: A Mathematics and Computation Summer Program for Incoming STEM Freshmen

Camille McKayle, University of the Virgin Islands
Co-Author(s): Aimee Sanchez and Robert Stolz, University of the Virgin Islands

The Mathematics Behind the Science (MBS) Summer Program seeks to provide a strong mathematics foundation for incoming students and increase students' understanding of and interest in computation, leading to more students taking computer science early in their college career. Students will be recruited from the pool of declared STEM majors who have been accepted to UVI. The Math Behind The Science bridge program includes four components: (i) pre-calculus or algebra component with a PLTL approach; (ii) scientific reading and writing; (iii) introduction to computing; and (iv) STEM Freshman Development Seminar (FDS) - How to be successful in STEM, with integration of growth mindset curriculum. The program resulted in the majority of students being placed in college level Calculus courses at the beginning of the Fall Session. We will discuss the format of the program, the curriculum and the outcomes.

Funder Acknowledgement: NSF HBCU-UP HRD HBCU-UP 1137472

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Poster Category: STEM Science and Mathematics Education

Peer Led Team Learning in Developmental (Foundations) Mathematics: An Approach to Retention

Robert Stolz, University of the Virgin Islands
Co-Author(s): Aimee Sanchez and Camille McKayle, University of the Virgin Islands

The University of the Virgin Islands is an open enrollment institution where approximately 70% of the incoming freshman

students place into one of two zero-credit pre-algebra courses. Peer Led Team Learning (PLTL) was implemented in these courses in order to impact pass rates and student retention and persistence. A preliminary pilot project for STEM majors showed an increased pass rate. This led to a wide-spread adoption of the approach for all developmental mathematics courses. This presentation will give an overview of the implementation, including curricular materials, and present data on the increased pass rates in those course.

Funder Acknowledgement: National Science Foundation HBCU -UP Grant No. HRD 1137472.

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Poster Category: STEM Science and Mathematics Education

Progress on a Biology and Mathematics Faculty Multidimensional Collaborations to Improve College Success of Undergraduates

Katharina Wollenberg Valero, Bethune-Cookman University, Daytona Beach, FL
Co-Author(s): Martine Levy Nelson, Franchelle Winder, Ada Harvey, Kelly Carey, Sulakshana Sen, Sarah Johnson, Thomas Roper, Hector Torres, Seenith Sivasundaram, and Raphael D. Isokpehi, Bethune-Cookman University, Daytona Beach, FL

Several national reports have identified that success in mathematics courses in the first two years of college correlates with retention and graduation in science, technology, engineering and mathematics (STEM) disciplines. Furthermore, collaboration with mathematics faculty is recommended as a strategy to improve mathematics success for college students. At Bethune-Cookman University, a private HBCU in Florida, math and biology faculty have established multidimensional collaborations intended to improve academic success of students. In the Fall 2015 semester, several activities were accomplished. Collaborating Math faculty who teach lower-level math courses incorporated data from biological research into course topics and assignments. The learning dispositions including metacognitive strategies were assessed in selected math courses. A math faculty is now serving as Campus Champion for the Extreme Science and Engineering Discovery Environment (XSEDE). Students in a first year math course had a collaborative problem-solving with biology majors enrolled in a senior year genetics course. Finally, a data analytics research training workshop series was offered to undergraduates. Future plans include: (1) the infusion of computer-based cognitive tutors to learning experience especially learning of statistical analysis; and (2) the development of infrastructure for building scientific argumentation expertise of undergraduate students. The overall impact of this math-bio faculty collaboration at Bethune-Cookman University is being evaluated.

Funder Acknowledgement: Increasing College Opportunity Through Improved Mathematics Success in the First Two Years of College (NSF 15-026). Supplemental Funding to Targeted Infusion Project HRD-1435186 funded by the HBCU-UP of the National Science Foundation.

Nanoscience

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Poster Category: STEM Research

Effect of Reinforcement of Eggshell-based Nanopowder on Biodegradable Flexible Polymer Blends

Vijaya Rangari, Tuskegee University
Co-Author(s): Boniface J.Tiimob and Shaik Jeelani, Tuskegee University

The need for compostable alternative packaging materials is an urgent one, due to the inevitable demand in copious quantities by the increasing consumer population. Unfortunately, the mostly used polymeric materials are recalcitrant to degradation, and contribute significantly to climate change issues now confronting the world. Common polymers used for flexible packaging include polypropylene (PP) and polyethylene (PE). The demands for such materials have surged in commensurate proportions to match the increasing demand by growing global population. Worldwide yearly plastics production is estimated to exceed 300 million tons by 2015. This represents trillions of dollars in terms of global economic returns. The over dependence on petroleum resources can be alleviated by bioplastics development from renewable resources. Currently, the bioplastics market is surging up and capturing the plastics consumer market by a rate of 30% annually. Hence, the development of more compostable substitute plastics will immensely help in offsetting the demand on petroleum resource consumption whiles curtailing the complex issues related to the environmental waste management and climate change. In this research, extruded compostable poly (butylene adipate-co-terephthalate) (PBAT)/agro-based polylactic acid (PLA) blend films were studied to select a suitable blend for further investigations. This blends (90/10, 80/20, 70/30, 60/40 and 50/50) were characterized using DSC, TGA, Raman spectroscopy, SEM and tensile testing. After this screening, the 70/30 blend was selected and further studied by blending with processed eggshell nanoparticles (> 30 nm in diameter by TEM analysis) as a property modifier. Eggshell nanoparticles have shown the potential in tailoring of weak polymer properties toward their enhancement, at the same time the inherent egg proteins in the shells have the potential of serving as biocides in the polymer matrix. DSC results revealed that the two polymers are immiscible, due to the presence of distinct melting points.

Raman spectroscopy revealed frequency vibrations and intensities unique and proportional to the ratio of the individual polymers. Also, SEM micrographs of the blends showed heterogeneous mixtures of the two matrixes with distinct phase separation. However, PLA lead to improvement in tensile strength and modulus whiles PBAT lead to significant improvement in train to failure of the blends systems. Inclusion of nano eggshell led to improvement in thermal stability of the 70/30 blend whereas tensile testing revealed significant improvement in strain to failure and strain at maximum load. Further studied will be investigated on the 70/30/eggshell blends to establish any bactericidal activity for potential packaging applications.

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Poster Category: STEM Science and Mathematics Education

Nanoscience Project at Hampton University (NanoHU): Broadening the Participation of Undergraduates in STEM Education with Nanoscience

Michelle Claville, Hampton University School of Science, Hampton University, VA
Co-Author(s): Sainath Babu, Roopchan Ramdon, Brandon C. Parker, and Calvin W. Lowe

The Nanoscience Project at Hampton University (NanoHU) is a five year project (2012-2017) funded by the NSF's Historically Black Colleges and Universities-Undergraduate Program (HBCU-UP). The goal of this project is to develop and systematically implement an integrated, multidisciplinary STEM research and education program in nanoscience at Hampton University. NanoHU has impacted the culture of Hampton University through the following: (1) the development of a new Nanoscience Minor; (2) the creation and offering of the new 'Introduction to Nanoscience' course; (3) the institution of the NanoHU Scholars Program; (4) the establishment of a Faculty Research Startup Awards Program; (5) the establishment of a NanoHU Seminar Series; and (6) the development and facilitation of a summer research outreach program for high school students called 'NanoHU Pioneers'. All students who pursue the nanoscience minor, learn first-hand about the intersectionality of the various scientific disciplines, especially as it relates to the nanoscale. The minor requires that students engage in nanoscience-related research throughout the entire academic year. The new Introduction to Nanoscience course serves as one of the physical science electives that may be used to satisfy the University's general education requirements, and has garnered the attention of students who major in STEM and non-STEM disciplines. The NanoHU Faculty Startup Award Program provides short-term support to junior faculty members to develop their own research interest in a nano-related field. The NanoHU Seminar program brings speakers from various fields related to nanoscience and nanotechnology to the Institution. The ever-popular NanoHU Pioneers Summer program allows high school students (rising 10th and 11th graders) to engage in six-weeks of faculty-led, laboratory research in nanoscience or nanotechnology. By way of these and other accomplishments, NanoHU is pioneering undergraduate STEM education in nanoscience, while positioning Hampton University as a leader in preparing nano-savvy graduates for entry into the Science and Engineering (S&E) workforce. In doing so, the program simultaneously provides a developing model of STEM education for other institutions, and supports the nation's charge to lead in global innovation.

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Physics

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Poster Category: STEM Research

Initiation of Research in Engineering Science through Optical and Electronic Characterization of Polycrystalline Si Semiconductor Wafers for Use in PV

Andriy V. Semychayevskyy, Lincoln University, PA
Co-Author(s): Harley T. Johnson, UIUC, Urbana, IL

This HBCU-UP RIA award's main objective is to initiate the PI's research on the structure-property relationships in semiconductor materials for photovoltaic solar cells working under different levels of incident light. This project is also meant to assist us in setting up our new Engineering Science program and in involving some of the current students in research. Dislocations and other defects in silicon and other electronic materials affect electronic transport properties, including carrier recombination rates and spatial distribution of carrier occupancy statistics. The carrier scattering and recombination processes affect the carrier dynamics in solar cells, and one of the interesting cases is the change in the electrical characteristics of PV solar cells when the photon flux density is varied. Until recently, most of the analysis used properties of bulk semiconductors to model carrier dynamics without any reference to the spatial distribution of defects or related electronic material properties. Modern characterization techniques, including spatially-resolved photoluminescence and photoelasticity can be used to deduce both the defect structure and the spatial distribution of carrier occupancies. Our collaborators at the University of Illinois at Urbana-Champaign

have produced a large number of IR transmission and PL images for polycrystalline Si wafers as a part of another NSF-sponsored research project (GOALI). These images will be used to generate input parameters for our carrier transport models. Three undergraduate minority students (Engineering, Computer Science, and Physics majors) have been hired to work on this HBCU-UP RIA project in November of 2015 to perform optical and electrical characterization of semiconductor wafers and also to do data analysis (image processing of PL images using Matlab). At the moment we have preliminary data that reveal the problem of photovoltaic conversion efficiency degradation at higher illumination densities, and we are working on the interpretation of the spatially-resolved PL images obtained from our collaborators. The PI has also been developing multiphysics models of carrier transport in polycrystalline semiconductors with spatially resolved electronic properties

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Poster Category: STEM Research

NSF-CREST: Advanced Center for Laser Science and Spectroscopy

Felix Jaetae Seo, Hampton University
Co-Author(s): Bagher Tabibi, Uwe Hommerich, and M. Patrick McCormick, Department of Physics, Department of Atmospheric and Planetary Sciences, Hampton University, VA

The CREST Advanced Center for Laser Science and Spectroscopy (ACLaSS) at Hampton University continues to enhance human resource development of minority students, and strengthen the research and education infrastructure. The goals of ACLaSS are to: 1) advance the research and education center with cutting edge laser sciences and spectroscopy; 2) develop and implement graduate and undergraduate educational modules; 3) provide extensive research and educational opportunities to graduate and undergraduate students; and 4) strengthen the pipeline of students pursuing advanced degrees in science and technology through outreach activities and summer workshops, and 5) provide educational opportunities in laser science and spectroscopy to high school teachers and students in grades K-12. The ACLaSS involves the participation of a diverse group of faculty and students from the Physics, Chemistry, and Atmospheric and Planetary Sciences Departments at Hampton University, as well as scientists at other national and international institutions, industries, and government agency laboratories.

The research thrusts in the ACLaSS at HU include laser spectroscopy and materials modeling, fluorescence spectroscopy and application, and laser remote sensing. The research activities of laser spectroscopy and materials modeling include the spectroscopic characterization of plasmon-coupled semiconductor quantum dots and Raman molecules for photonic applications of light amplifications, chemical molecular sensing, and nonlinear optical modulations. The research activities of fluorescence spectroscopy and application include the development of low-quantum defect gain media for eye-safe lasers. The development of new laser gain media continues to be an active area of research with a large range of potential applications for the civilian and military sectors. The research activities of laser remote sensing include the measurements and analyses of aerosols, planetary boundary layer, wind speed, water vapor, temperature, cirrus clouds, polar stratospheric clouds, and carbon dioxide. The current research is focused on expanding the capabilities of lidar systems to include new atmospheric retrievals and aerosol characterization.

Funder Acknowledgement: The CREST program at HU is supported by the NSF HRD-1137747.

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Poster Category: STEM Research

Multimodal and Integrated Approach for Detection and Characterization of Nanoparticles Embedded in Polymeric Systems

Hacene Boukari, Delaware State University
Co-Author(s): Yury Markushin and Qi Lu, Physics and Engineering Department, Delaware State University
Noureddine Melikechi, Optical Science Center for Applied Research, Delaware State University

As one of three subprojects supported by our CREOSA center, we have assembled a collaborative team of researchers to devise and implement an integrative, optical-based approach for precise detection, accurate identification, and in-situ characterization of specific biomacromolecules embedded in various biologically-relevant matrices. Our overarching goal is the development and/or application of high-resolution optical and imaging methods such as laser-induced breakdown spectroscopy, photothermal lensing spectroscopy, fluorescence correlation spectroscopy, and fast sheet illumination microscopy to investigate in-situ biomacromolecular interactions in the presence of a host matrix. We will design novel immunoassays to label the biomacromolecules with suitable fluorescent or metallic probes, allowing efficient and accurate detection of several biomacromolecules simultaneously. As an example, we have focused on understanding the dynamics of various nanoparticles (e.g. fluorescent Alexa488; amino-acids) embedded in a host Ficoll solutions prepared at different concentrations (up to 1200 mg/ml). Ficoll is a water-soluble, branched polysaccharide. We applied several techniques (fluorescence correlation spectroscopy, fluorescence anisotropy, dynamic light scattering, and rotational viscosity method) to

measure the effect of ficoll crowding on the rotational and translational diffusion of Alexa488 (MW=665Da). We find the rotational and translational diffusion times to depend exponentially with on the ficoll concentration. This dependence cannot be accounted for by the changes of the bulk viscosity as would suggest the Stokes-Einstein model. Rather, they can be attributed to changes of the local microviscosity created by the ficoll-water system. However, Alexa488 appears to "observe" a reduced microviscosity (~ ½) for its rotational motion different from that "observed" while translating. In a second experiment, we assessed the possibility of resolving the structural differences between three amino-acids (L-Serine, L-Cysteine, and L-Glutamine) while embedded in a host ficoll solution. Here, we used laser-induced breakdown spectroscopy (LIBS) and measured the spectra emitted by the mixtures of ficoll and amino-acid. Data analysis yields subtle differences in the spectra, allowing classification of the spectra. Although additional work is needed, these preliminary results indicate the potential use of LIBS as a detection and characterization tool.

Funder Acknowledgement: National Science Foundation (NSF-CREST grant # 1242067)

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Poster Category: STEM Research

The Center for Gravitational Wave Astronomy in the Centenary of Einstein's Theory of Relativity

Mario C. Diaz, University of Texas Rio Grande Valley
Co-Author(s): Matthew Benacquista

In this poster we discuss the participation of the CGWA in the efforts to detect gravitational waves with the Advanced LIGO detectors. The Advanced LIGO detectors are funded by NSF to detect gravitational waves from astrophysical sources, including the merger of compact binary objects like Black Holes and neutron stars, other cataclysmic explosions that occur in our universe, and even the murmurs remnant of the big explosion in which our universe originated. On September 18 of 2015 Advanced LIGO started its first scientific run after a major instrumentation upgrade that have increased its sensitivity many times. In this poster we present some results from this first run and the contributions of our center as a member of the LIGO Scientific Collaboration (the multinational multi-institutional scientific collaboration that process and studies the data from the detectors and sustains their operational effort). These results will be presented in 2016 when the community celebrates the hundredth anniversary of the prediction of the existence of gravitational waves as a result of the theory Einstein developed in 2015.

Funder Acknowledgement: National Science Foundation: National Aeronautic and Space Administration

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Poster Category: STEM Research

Sustainability and Growth of CREST: Leading Research and Education through Innovation and Economic Development

Mohammad Khan, Optical Science Center for Applied Research (OSCAR), Delaware State University
Co-Author(s): Noureddine Melikechi, Optical Science Center for Applied Research (OSCAR), Delaware State University

The CREST program strives to integrate its strong research and education initiatives with innovation and economic development to realize underlying goal of sustainability and growth. The main focus of the program is to be leader in research and innovation in optics based technologies while furthering its multi-faceted goals tied into advancing knowledge based academics and students success. To this end CREST has nurtured talented professionals, faculty and staff researchers that are expert team of scientists, physicists, engineers and chemists. Our goal is to work in close collaboration with industry and government laboratories to develop and commercialize technologies with wide application areas of application. Successful outcomes has enabled few notable initiatives: (1) Close collaboration with industry and incubator program and forge innovation in the new research (Optical Science Center for Applied Research-OSCAR) facility at Delaware State University; (2) Synergize cohesive research and innovation under the newly formed Delaware Institute of Science and Technology (DIST) that brings together multidisciplinary group of researchers and multi-institutional collaborations that include partnering with federal, state, and local scientific and industrial communities under one umbrella; and (3) Enhance and facilitate professional development and grantsmanship activities (including infrastructure capacity building grants and SBIR and STTR initiatives) and partnership with industry members, government agencies and private foundations.

Funder Acknowledgement: National Science Foundation (NSF-CREST grant # 1242067).

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Poster Category: STEM Research

CREST Phase II: Computational Center for Science and Education at North Carolina Central University (NCCU)

Branislav Vlahovic, North Carolina Central University
Co-Author(s): Alate Tokuta, Diane Markoff, Gordana Vlahovic, and Marvin Wu

We present the research and educational accomplishments of the Computational CREST Phase II Center at North Carolina Central University. The cornerstone of the center is the

combination of unique expertise and infrastructure at NCCU, which results in strong, synergistic research. The Center consists of four interdisciplinary projects listed below and seed projects. The center involves 15 senior investigators from five NCCU STEM disciplines actively collaborating with scientists from Duke University, Jefferson and Oakridge National Laboratories, and Center for Earthquake Research and Information at University of Memphis.

The computationally driven research programs include four complementary and closely interwoven projects: (1) Development of novel nanomaterials and application of these materials in advanced optoelectronic devices; (2) Low-to-medium-energy nuclear and hypernuclear few-body physics; (3) Intelligent systems and robotics; and (4) Geophysical characterization of intraplate seismic zones. The projects are internationally recognized and have the potential to significantly impact their respective scientific fields. The computational structures developed in Phase II have already resulted in significant new contributions in all of the four areas, and have thereby positioned NCCU closer to the goal of establishing a National Center in Applied Computational Sciences. The center has broadened the educational and research capacities at NCCU, and is leading the transformation of NCCU from a teaching to a research intensive institution. This will enable the expansion of Ph.D. programs to all STEM disciplines at NCCU, thereby contributing to a more diverse scientific workforce. The educational impact of Center activities are: a) improved matriculation, graduation and progression rates, especially among African-American students, women, and socially and economically disadvantaged students; b) improved curricula for undergraduate and graduate students in the STEM disciplines and new undergraduate and graduate computational degree programs; c) graduates trained in specialties critically needed by the industry; and d) greater awareness of applied computational sciences among middle and high school students and the general public. The HBCU computational science network established by this center will create opportunities for student participation in advanced research and facilitate collaboration among HBCU faculty and students, and with major research institutions and industry.

Funder Acknowledgement: This work is supported by NSF HRD -1345219 award.

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Poster Category: STEM Science and Mathematics Education

Relating Entrepreneurial Thinking to Student Outcomes in STEM

Caesar R. Jackson, North Carolina Central University
Co-Author(s): Alade Tokuta, North Carolina Central University
Tanina Bradley

The HBCU-UP project at NCCU entitled 'DREAM STEM' - Driving Research, Entrepreneurship, and Academics through Mastering STEM, seeks to provide an innovative approach to enrolling, retaining, and training students in STEM degree programs. In this project, we devised an Entrepreneurship in Science Education component as a strategy to attract and hold students' interest and academic pursuit of STEM through entrepreneurial thinking and training. We are interested in knowing if students developed for entrepreneurial thinking and getting entrepreneurial training will enroll in, be retained in, and persist in STEM degree programs at NCCU at a higher rate.

In summer 2014, Entrepreneurial thinking training was embedded in the DREAM STEM Summer REU program through seminars and workshops and field trips. The entrepreneurship thinking training activity was designed to promote business awareness and introduce students to entrepreneurship concepts related specifically to STEM fields, such as creativity and opportunity recognition, industry and market analysis, development of sales and financial projections, operations design, small business management, and small business legal structures. We administered a survey (pre/post) that included a Scientific Research Process Skill Assessment and an Entrepreneurial Skill Assessment. The scientific research process skill assessment was used to assess gains in scientific research skills acquired by the REU students. The Entrepreneurial Skill Assessment was used to assess entrepreneurial readiness due to the entrepreneurial thinking training provided to the REU students. The Entrepreneurial Skill Assessment survey items were based on Lichenstein's and Lyons' which defined four categories that help assess students' entrepreneurial readiness: 1) Technical knowledge; 2) Managerial knowledge; 3) Entrepreneurial Skills and Characteristics; and 4) Personal traits.

We will present results on the following: 1. Pre-Post gains for 2014 DREAM STEM Summer REU students surveyed on: a) Personal Traits scale of Entrepreneur Skill Assessment due to the Entrepreneurial thinking training activity, and b) Scientific research process scale due to summer research experience. 2. Predictive validity determined by correlation and regression analysis of above two scales with fall and spring semester grades in the STEM courses. 3. Comparison of faculty mentor assessment of student scientific research process skills to students' self-report of their skills.

Funder Acknowledgement: Funded by National Science Foundation; Award No. HRD-1238547

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Poster Category: STEM Science and Mathematics Education

Targeted Enhancement of the Undergraduate Physics Program in the Department of Physics and Astronomy at Howard University

Prabhakar Misra, Howard University
Co-Author(s): Demetrius Venable, Belay Demoz, and Gregory Jenkins, Howard University, Washington, DC

The targeted enhancement of the undergraduate program in the Department of Physics and Astronomy at Howard University has been accomplished via implementation of the following four major initiatives, namely conversion of the existing General Astronomy course into a hybrid online/laboratory class, significant upgrading of the planetarium and telescope astronomical observatory, successful implementation of both an Atmospheric Science minor and a recruitment/scholarship program and peer support/tutorial program for physics majors. Infrastructure has been considerably enhanced by the upgraded facilities in the Locke Hall Planetarium and Telescope Observatory. The new telescope in the observatory and the full-dome projector in the planetarium have helped to dramatically increase the number of impactful outreach events. A series of new planetarium shows and enriched telescope hands-on activities and student-instructor interactions have helped reinforce the learning material covered in the hybrid General Astronomy course lectures. Based on the student feedback responses to regularly conducted surveys, the knowledge base and engagement of the students taking the hybrid course have been markedly improved, and as a consequence it is anticipated that the future enrollment in the course will show a measurable increase too. Improving teaching, learning and critical retention of key concepts, by developing more effective pedagogical approaches - such as hybrid courses and hands-on activities - will better prepare STEM majors for the professional workforce. Besides STEM majors, the targeted infusion project has the potential to make the hybrid General Astronomy course offering more attractive to humanities and social science majors as well, as more fascinating planetarium shows have become available and additional outreach events are being held that utilize the enhanced telescope for observations of the Washington night sky and rare celestial events. Greater involvement of the community at-large - via increased frequency of public outreach activities - serves to enhance the image of Howard University as a civic partner by engaging the public in enriching open house events, which in turn will also help in the recruitment of additional physics majors to the Department of Physics and Astronomy at Howard University.

Funder Acknowledgement: Financial support from the National Science Foundation (Award No. HRD-1238383) is gratefully acknowledged.

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Poster Category: STEM Science and Mathematics Education

Student Support and Success-A Data Driven Story from CREST at Delaware State University

Mukti M Rana, Optical Science Center for Applied Research (OSCAR), Delaware State University
Co-Author(s): Noureddine Melikechi and Jackie Jones, Optical Science Center for Applied Research (OSCAR), Delaware State University

The Center for Research and Education in Optical Science and Applications (CREOSA) was established in 2005 under the support from Center for Research Excellence in Science and Technology (CREST) program of NSF. CREOSA involves faculty members from the Department of Physics and Engineering, Computer and Information Sciences, Mathematics and Chemistry of DSU. Second Phase of CREOSA started in 2012 to fulfil the goals: (a) Broaden participation and enhance diversity in optical sciences research and STEM workforce; (b) create a robust and sustainable research infrastructure at DSU in terms of people, equipment, and access to scientific information; (c) disseminate new knowledge about optics and facilitate engagement in science by students at all levels as well as the public; and (d) establish and maintain national and global partnerships and collaborations that will enhance the visibility of optics as a discipline and enhance CREOSA's long-term sustainability. CREST has been fully integrated with University Research Center supported by National Aeronautics and Space Administration (NASA) for leveraging resources and other activities. Between 2012-2015, OSCAR has trained about 30 undergraduate students and ten high school students per year to support their research and education. The majority of these students are form African American ethnic group. In the past three years, OSCAR also supported twenty graduate students per year to pursue their degrees. In the last three years, OSCAR helped to produce three PhD's, thirteen Masters with their research focused in Optics. At the same time, OSCAR helped to produce thirty eight undergraduates in various science majors (mostly BS in Engineering Physics). Most of the OSCAR graduates had been employed in various government organizations, academia and industries or had been admitted to graduate schools. OSCAR has been instrumental in Outreach activities which involve arranging science fair for middle/high school students in Kent County of Delaware, arranging tours for local school students and arranging other activities for local students.

Funder Acknowledgement: This work has been supported by National Science Foundation under the CREST program, grant number: HRD-1242067.

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Poster Category: STEM Science and Mathematics Education

Undergraduate Research and other Collaborations Between TYCs and 4yr+ Universities

Tim Usher, California State University San Bernardino
Co-Author(s): Alec M. Sim, Irvine Community College
Joseph C. Farmer, College of the Desert
Michael S. Butros, Victor Valley College

As part of a NASA-CIPAIR grant and a NSF-CREST grant, we initiated several innovative activates that have greatly strengthened the ties between three two year colleges (TYC), three 4yr+ universities and a NASA Center. One of the innovations has been given the moniker, 'winternships.' These are three to four week research 'boot camps' conducted at TYCs during the winter break. The students work in teams on research projects. The timing of the winternship corresponds with the open application timeframe for summer research internships at, NASA, National Labs, and REU programs. Students are required to apply for at least three of these internships. Furthermore, having worked with the students closely TYC faculty can provide letters of recommendation that speak to more than just a student's performance in the classroom. However, by far the most important aspect of the winternship is that it builds student confidence. Other collaborative activities will be presented.

Funder Acknowledgement: NSF-CREST award number: 1345163 and NASA-CIPAIR grant number: NNX11AQ99G

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Poster Category: STEM Science and Mathematics Education

TIP: Piloting a Physics Partnership: Year 3 Update

Donald Walter, South Carolina State University
Co-Author(s): Jennifer Cash, Daniel Smith, and Reginald Williams, South Carolina State University, Orangeburg, SC
Richard Murphy and James Payne, Orangeburg-Calhoun Technical College, Orangeburg, SC

Our HBCU-UP Targeted Infusion Project (TIP) has brought together the faculty and administrators of a four-year HBCU and a nearby two-year, Predominately Black Institution (PBI) to "… form a successful physics partnership between South Carolina State University (SCSU) and Orangeburg-Calhoun Technical College (OCtech) that will strengthen both programs and serve as a model of best practices for developing a STEM collaboration." We report on our successes and challenges after more than two years of a three year project funded by the National Science Foundation. OCtech has modified its physics instruction using a new textbook and online homework to enhance the problem-solving skills of their students. The TIP project is funding a math instructor at OCtech who is engaged in physics coursework at another university to prepare him for certification to teach physics at OCtech. Faculty members from both OCtech and SCSU are team-teaching the physics lecture and lab courses for the first time in the history of the two schools. OCtech has provided training for SCSU faculty in the use of LabVIEW software, project-based instruction and alternative energy activities. SCSU has tested and incorporated Invention Instruction activities in the introductory physics lecture and lab courses.

Additionally, we have developed over 150 videos of short length on select math and physics topics that are viewed by the students prior to class as part of the "flipped" or "scrambled" method of instruction. A member of the SCSU education faculty is serving as the evaluator for the project and has three semesters of results measuring the effectiveness of the new methods of teaching. He has conducted an assessment of our flipped instruction using a variety of techniques including pre- and post-testing, focus groups and individual student interviews. We discuss the evaluation results to date.

Funder Acknowledgement: Funding for this project has been provided by the National Science Foundation through award HRD-1332449.

Science and Mathematics Education

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Poster Category: STEM Science and Mathematics Education

HBCU-UP Implementation Project: Student Centered Active Learning and Assessment Reform (SCALAR) at Florida A&M University

Maurice Edington, Florida A&M University
Co-Author(s): Lewis Johnson, Desmond Stephens, Charles Weatherford, and Shanalee Gallimore, Florida A&M University

This presentation will highlight results from Florida A&M University's (FAMU) HBCU-UP Implementation project 'Student-Centered Active Learning and Assessment Reform (SCALAR).' The goal of SCALAR is to significantly revamp and enhance the instructional approaches, course curricula, academic support services, and co-curricular activities in the STEM programs of the College of Science and Technology. The project PI and Co-PIs will highlight key project strategies and present data and results demonstrating how the project has impacted student learning. Specific project activities that will be discussed include faculty development efforts designed to increase faculty use of active/ collaborative learning techniques, effective methods for

assessing and enhancing critical thinking skills, and the use of Learning Assistants to improve student performance.

Funder Acknowledgement: Funded by the National Science Foundation (NSF) Historically Black Colleges and Universities-Undergraduate Program (HBCU-UP) Grant award HRD-1332520.

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Poster Category: STEM Science and Mathematics Education

Broadening Participation Research Project: Exploring Computing Careers through a Virtual Career Fair using Embodied Conversational Agents

Kinnis Gosha, Morehouse College
Co-Author(s): Chance Lewis and Jennifer Albert

The vision for the Exploring Computing Careers Broadening Participation Research project is to develop a virtual career fair using embodied conversational agents (ECAs) that will engage students in career discussions and, if they have interest in computing, help inspire them to reach their potential in computing careers. High school students in North Carolina and undergraduate students of Morehouse College will benefit by receiving up-to-date career information from computing professionals currently in the field via the ECAs. ECAs will be presented to students in three formats; traditional question and answer, storytelling, and culturally relevant storytelling. Students in both rural and urban settings will be compared across a variety of measures including self-efficacy, career interests and their responses to the three types of ECAs. In addition, a cohort of four undergraduate students from Morehouse College will participate throughout the project by creating ECAs, collecting and processing data, and receiving extensive training by two educational researchers.

The Exploring Computing Careers project is innovative in that: 1) Students will receive career information through ECAs; 2) ECAs will be developed to be culturally relevant; 3) Students in both rural and urban contexts will be compared; and 4) Assistantships in Computer Science at Morehouse College will be enhanced through additional training in research methods and careers. Intellectual Merit. The Exploring Computing Careers project builds upon work with ECAs as mentors to undergraduates interested in attending graduate school (Gosha, 2013). The ECAs for this project will be constructed using interviews with computing professionals currently working in the field to ensure relevant, up-to-date information using indicators of success for African Americans as a guideline (Bonner, Lewis, Bowman-Perrotm Hill- Jackson, & James, 2009). Previous work showed no significant differences between ECAs and human mentors when helping undergraduates make decisions about pursuing graduate studies. Many of the students who will participate in this study represent a population that is currently underrepresented in computing majors and careers. Previous work in similar districts used STEM career videos shown throughout the school year to middle school students as a means of influencing student awareness of and interest in STEM careers (Blanchard, Albert, Williams, & Alsbury, 2013). These students showed increased knowledge of careers and more sophisticated interests. They also found that the presence of role models was a predictor of interest.

This project will expand upon this understanding and connect it specifically to students' interest in pursuing a degree, computing or other, at a HBCU.

Broader Impacts. The Exploring Computing Careers project implements an innovative, sustainable solution for bringing career information to urban and rural, high need districts to foster entry of underrepresented students into computing majors and careers. Data collected on student attitudes, interest, knowledge of careers, self-efficacy and perception of possible selves will help to guide improvements to the ECAs. At the conclusion of the research, the infrastructure (i.e. embodied conversational agents, career content, etc.) will remain in place, online for any teacher, student, or parent wishing access. In addition, as undergraduate research assistants with extensive training, these students will be well suited to pursue graduate studies. Twelve of Dr. Gosha's students elected to pursue a Ph.D. in Computer Science over the last three years. Findings will be presented at local and national conferences and through journal publications.

Funder Acknowledgement: The NSF

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Poster Category: STEM Science and Mathematics Education

Incorporating Field Based Experiences for Science Teaching

Trina L. Spencer, Virginia State University
Co-Author(s): Leslie Y. Whiteman and Tracy M. Walker, Virginia State University

This poster will briefly share the presenters' current work to increase the interest, pedagogical skills, confidence and expertise of pre-service elementary education teachers to teach science utilizing research-based instructional methods. It will highlight keys ideas on why educational programs should re-examine how preservice teachers are trained to teach science, and discuss why incorporating field-based experiences in informal educational settings should be encouraged. The poster will also present data that shows what knowledge, skills, and insights the elementary preservice teachers gained from visiting two local science museums. It will how these experiences helped to expose preservice teachers to the practical application of scientific concepts.

Funder Acknowledgement: HBCU- UP- National Science Foundation-Targeted Infusion

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Poster Category: STEM Science and Mathematics Education

Coaching for Academic and Professional Success in Science, Technology, Engineering, and Mathematics (CAPS in STEM)

Hendricus G. 'Rik' van Antwerpen, School of Mathematics, Science, and Technology, Virginia Union University
Co-Author(s): Phillip W. Archer, School of Mathematics, Science, and Technology, Virginia Union University
Zakir Hossain, Division of Academic Affairs, Virginia Union University

This 5-year project is designed to increase the number of STEM graduates from Virginia Union University (VUU), a private, urban, historically black college in Richmond, Virginia. The main objectives of the project are to increase recruitment, retention, and graduation rates in all STEM disciplines at VUU by at least 50%, while maintaining the academic rigor that is required for student success after graduation. To meet these objectives three strategic initiatives are implemented: (1) The establishment of a STEM summer program that improves the preparedness of rising freshmen for their first semester in college. Summer activities are anticipated to improve student performance in gate-keeping courses, and to generate additional positive effects throughout the students' four-year matriculation; (2) The implementation of high-impact educational practices across the STEM curricula. Specific faculty development activities will allow instructors to initiate on-campus research projects, to stay current on best practices in STEM education, and to implement new approaches for teaching discipline-specific skills and content; and (3) The establishment of a STEM Career Coaching Team. The best indicator for academic and professional success may be a student's passion for the discipline combined with a well-defined career goal. A critical part of this project concentrates on the personalized guidance of STEM students by full-time, discipline-specific STEM Career Coaches.

Using an evidence-based approach, these three strategic initiatives will help to optimize conditions for minority student success in undergraduate STEM education, with special consideration for students who are underprepared for the academic and extracurricular demands of a successful college career. While the strategies implemented in this project are designed to improve STEM education at VUU, they are anticipated to be equally effective at other Historically Black Colleges and Universities (HBCUs) and at non-HBCUs.

Funder Acknowledgement: This work is supported by a grant from the National Science Foundation (HBCU-UP; HRD-1238719).

Social, Behavioral and Economic Sciences

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Poster Category: STEM Research

The Fostering Retention in STEM Disciplines at HBCUs

Vivian L. Carter, Tuskegee University
Co-Author(s): Laurette Garrett, Mohammed Qazi, and Chadia Aji, Mathematics, Tuskegee University
Li Huang, Psychology and Sociology, Tuskegee University

The Fostering Retention in STEM Disciplines at Historically Black Colleges and Universities (HBCUs) project is a Broadening Participation Research project that will provide an in-depth look at influences present in STEM disciplines at HBCUs. The study will be based at Tuskegee University, an institution noted for its strength in STEM education, but will also include data collection at HBCUs in other parts of the country. It will examine the interplay between psychosocial factors (e.g. motivation) and academic structural factors (e.g. mentoring) that affect the retention of minority students at these institutions.

The objectives are: 1) to determine the most prominent psycho-social factors that affect student retention in STEM programs; 2) to identify the structural factors that lead to the successful retention of students in STEM programs; 3) to gain insight into the issues that influence the effectiveness of those structural factors; and 4) to develop a manual describing suggestions for best practices. The study makes use of a three-year multi-methodological approach that integrates secondary data analysis, interview, and survey data to determine the most effective means by which to retain minority students in STEM disciplines. The methodology is based in the premises of phenomenology and community-based participatory research to allow the views of those who are actively engaged in STEM programs at HBCUs to inform the results.

An initial qualitative phase will inform a second quantitative phase. A final qualitative phase will build upon the previously collected data. Populations included will be: 1) students enrolled in STEM disciplines at HBCUs; 2) STEM faculty at HBCUs; 3) administrators and other non-faculty personnel at HBCUs involved with STEM retention; and 4) successful HBCU graduates of STEM programs.

Funder Acknowledgement: National Science Foundation, Broadening Participation in Research (BPR) Grant.

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Poster Category: STEM Science and Mathematics Education

Understanding Barriers to STEM Education for African American Women

Lawanda Cummings, Paine College, Augusta, GA
Co-Author(s): LaShawnda Lindsay-Dennis and Tantiana Burns, Paine College, Augusta, GA

There is a current agenda to increase the number of minorities in STEM careers to secure the U.S. as a global power in STEM innovation and business. In a recent report of the President's Council on Advisors on Science and Technology (PCAST, 2012), it was noted that a million more STEM baccalaureates would be needed in the next 10 years. Research suggests that the underrepresentation of women and students of color in STEM careers is the product of contextual and psychological factors that shape academic and career choices long before students arrive on a college campus (Perry et al., 2012). Gender disparities in STEM careers are primarily driven by socio-cultural factors rather than a lack of capacity or intellect among women (Hill et al., 2010). For example, a review of research by Ong and colleagues (2011) reveals that despite early interest in science and math, three-fourths of women of color working in STEM field indicated that they were never identified or encouraged to pursue STEM studies, and 40% reported being actively discouraged. Additionally, negative stereotypes about girls' abilities in math and science have been found to influence self-efficacy, educational choices, academic performance in math and science, and interest in pursuing STEM training and careers (Perry et al., 2012; Steele & Ambady, 2006; Bandura, 1993). Additional research is needed to understand the unique double minority experience of African American female students.

The current study, funded by NSF-HBCU-UP, is longitudinal research that follows freshman and sophomore students for 3 years. Using year 1 and year 2 data, a comparative analysis of STEM vs. Non-STEM African American women was conducted to identify within-group differences associated with contextual factors that promote or inhibit pursuit of STEM focused degrees. Preliminary analysis of baseline interview data and self-reported data in utilization patterns indicate differential trends in use of campus-based supports such as tutoring, faculty mentoring, and participation in academic student organizations. All students reported similar general academic self-efficacies ($t(72) = -1.19$, $p = .24$), indicating a strong self-perceived capacity for academic success despite degree field. In contrast, STEM students were twice as likely to utilize contextual supports ($t(72) = 1.72$, $p < .03$), and reported greater domain specific efficacies than their Non-STEM counterparts (Math: $t(71) = 2.12$, $p < .05$ and Science: $t(72) = 2.17$, $p < .05$).

Interview data further explicates patterns of help-seeking behaviors indicating that Non-STEM and STEM students generally seek assistance from peers instead of traditional academic supports. Participants also reported limited pre-college preparation despite their field of study. Additionally, the lack of a fully formulated plan or career trajectory for both STEM and Non-STEM students means limited understanding of intermediate tasks needed for goal accomplishment. A greater understanding of the role of contextual supports and efficacy development would elucidate the need for population-specific contextual supports for Black Women in STEM fields.

Works Cited: Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. Educational Psychologist 28(2): 117-149.
Hill, C., Corbett, C., & St. Rose, A. (2010). Why so few? Women in science, technology, engineering, and mathematics Washington DC: American Association for University Women.
Ong, M., Wright, C., Espinosa, L.L., Orfield, G. (2011). Inside the Double Blind: A Synthesis of Empirical Research on Undergraduate and Graduate Women of Color in Science, Technology, Engineering, and Mathematics, Harvard Educational Review.
Percy, B. L., Link, T., Boelter, C. & Leukefeld, C. (2012). Blended to science: Gender differences in the effects of race, ethnicity, and socioeconomic status on academic and science attitude among sixth graders. Gender and Education, pp. 1-19. Psychology, 42, 190-198.

Funder Acknowledgement: National Science Foundation: HBCU -UP

Technology and Engineering

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Poster Category: STEM Research

Development and Study of an Implicit Model for Rapid and Accurate Simulation of Hurricane Storm Surge

Muhammad Akbar, Tennessee State University

In this poster, a parallel storm surge model based on hybrid finite element and finite volume techniques to solve hurricane induced storm surge flow problem is presented. As a hurricane approaches the coastline, a combination of meteorological and hydrological forces causes sea water to rise and rush inland, causing a storm surge. A quick and accurate prediction of a storm surge, its extent, and the possibility of breaching levees are crucial for disaster planning. Storm surge models are used to predict these surges. Storm surge models solve shallow water equations to simulate the hurricane induced floods. The hurricane induced wind stress and pressure, bottom friction, Coriolis Effect, and tidal forcing conditions are used as inputs to this model. Almost all surge models use explicit solvers. An explicit solver finds solution at a new time step based on that at the previous step. The algorithm is easy to implement, but

stability requirements heavily restrict the time step size - leading to a longer surge forecasting period. An implicit solver, on the other hand, finds the solution at a new time step using the information of the same step. This algorithm has its own challenges, but it can use larger time steps potentially minimizing simulation time. The implicit solver technique developed in the first year, has been implemented in ADCIRC framework this year. The implementation is currently being benchmarked. Application of the implicit solver in the ADCIRC framework was one of the ultimate objective of the present research. The developed storm surge model is used to hindcast Hurricane Katrina (2005). The simulated Maximum Envelope of Water (MEOW) and High Water Marks (HWM) are compared with published data. The comparison is reasonably good. The results are used to compare parallel performance of the model to the sequential version of the model.

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Poster Category: STEM Research

Probing the Interactions Between α-1, 4-Mannobiose Molecules, Using AFM

Komitige Hashanthi Perera, Howard University
Co-Author(s): Saswati Basu and Preethi Chandran, Howard University

Carbohydrate-carbohydrate interactions (CCIs) have been recognized to govern a wide range of biological processes including species-recognition, fertilization, embryogenesis, and cell development. The goals of our study are to investigate whether mannobiose moieties exhibit carbohydrate-carbohydrate interactions and to determine the solution conditions in which the interactions occur. Mannobiose moieties are disaccharides of mannose sugars. They coat the surfaces of pathogens and immune cells, and are extensively involved in host-pathogen interactions. The oligosaccharides are widely used in the design of drug-delivery vehicles for targeting cells that express mannose receptors (e.g., dendritic cells) and for reducing the drug-induced cytotoxicity. The finding that mannobiose moieties exhibit CCI will therefore impact the field of immunotherapy and the design of drug-delivery vehicles. CCIs between α-1, 4-mannobiose moieties were measured using the force spectroscopy (FS) mode of an atomic force microscope (AFM). The mannobiose molecules were covalently attached to thiolated linkers and assembled as monolayers on gold-coated mica and AFM tips. The mannobiose exposure on these functionalized surfaces was verified by its selective binding of the lectin concanavalin-A. The strength of CCI between the mannobiosylated surfaces was determined as a function of the monovalent and divalent ion concentrations in the solution, and of the pH. Control experiments were designed to measure the interactions between the thiolated linkers. Our results indicate that there are self-adhesive interactions between the mannobiosylated AFM surfaces. These interactions tend to be in the range of 200-800 pN, and predominantly occur as multiples of ~200pN. The addition of free mannobiose diminishes the adhesive forces. We are currently investigating the effect of solution conditions on the magnitude of the interactions. The conclusion of our study is that mannobiosylated surfaces exhibit complex potential for interactions, which can be harnessed for the design of immunotherapies and of drug-delivery vehicles.

Funder Acknowledgement: NSF HBCU-UP Research Initiation Award

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Poster Category: STEM Research

Center of Excellence in Nanobiomaterials Derived from Biorenewable and Waste Resources

Mahesh Hosur, Tuskegee University
Co-Author(s): Vijaya Rangari and Shaik Zainuddin, Tuskegee University, Tuskegee, AL
Maria Auad, Auburn University, Auburn, AL
Anil Netravali, Cornell University, Ithaca, NY
Haibin Ning, University of Alabama at Birmingham

Center of Excellence in Nanobiomaterials Derived from Biorenewable and Waste Resources was established at Tuskegee University (TU) with the funding from NSF for a period of five years starting October 2011. Collaborators from within the USA include Auburn University (AU), Cornell University (CU), the University of Alabama at Birmingham (UAB), and several industry and national laboratories. International collaboration is built upon the existing relationships with researchers from Brazil and India. The research focus areas of the proposed center include: (a) synthesis of plant based nanofibers through electrospinning and Forcespinning™ methods; (b) production of bacterial cellulose fibers from soy waste products; (c) synthesis of nanoparticles from biodegradable sources such as egg shells and their use as nano-fillers in advanced composites; (d) synthesis of biopolymers; (e) development and characterization of advanced green nanocomposites using these materials with natural fibers; and (f) product design, prototyping and commercial feasibility studies.

These efforts are being carried out through three sub projects: 1) Synthesis and characterization of nanobiomaterials; 2) Synthesis and characterization of biopolymers and nanobiocomposites,;and 3) Processing, performance evaluation and technology transition of green nanobiocomposites to products. The materials developed will provide an alternative to

the current generation of high performance 'advanced' composites materials which use thermoset polymers and man-made fibers like glass, carbon and Kevlar®.

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Poster Category: STEM Research

UNM Center for Water and the Environment: An NSF CREST Center

Kerry J. Howe, University of New Mexico

This poster will describe a CREST Center that was awarded in 2014 to the University of New Mexico, called the Center for Water and the Environment. Few resources are as important to human health and welfare as water. A reliable source of water is critical to society; indeed, water is necessary for life itself. The Center for Water and the Environment is investigating technological solutions to problems with water and the environment, with a focus on water problems in arid environments and in times of drought, including those associated with deteriorating watersheds, climate change, water needs for energy development, and technologies to address these challenges. These issues are critical to the Southwestern U.S. but also have global importance. The research component is organized around four topics: watershed processes, water treatment technologies, water/energy interactions, and research integration. This Center will generate significant new knowledge about the management and treatment of water in arid and semi-arid environments. It will have regional and global consequences as climate change and population growth cause a decrease in water supplies.

The poster will give an overview of the research activities in progress in these areas. Specific programs for recruiting, retention, and graduation of minorities are an integral feature of the Center. Innovative programs in this Center will include construction of a water technology demonstration trailer with hands-on water activities for K-12 students, a dual-credit high school course, and a water competition. These activities will create a pipeline of new STEM professionals to address the water problems of the future. UNM has significant populations of Hispanic and Native American students. This center seeks to attract minorities into STEM careers because young people from the Hispanic and Native American cultures of the desert southwest instinctively understand the vulnerability of the water and its importance. These aspects of the Center will also be described in the poster.

Funder Acknowledgement: National Science Foundation CREST

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Poster Category: STEM Research

Using Peer-Generated Screencast in Teaching Computer-Aided Design

Xiaobo Peng, Prairie View A&M University
Co-Author(s): Dongdong Zhang, Prairie View A&M University, Prairie View, TX
Bugrahan Yalvac, Texas A&M University, College Station, TX

Screencast is an effective learning tool for computer-aided design (CAD) education. In the screencast, the procedural operations of making three-dimensional (3D) models are presented visually along with the audio narration, which is effective and intuitive. Traditionally, instructor-made screencasts have been given to students after class for reinforcing their learning. However, the students have been kept in a passive role in this learning process. Students did not participate in designing the material that they learn. This poster presents the implementation of a student-centered instructional strategy in teaching CAD in the undergraduate level. Student participants were asked to generate the screencast tutorials in groups and then share them with their peers in a collaborative learning environment. Students watched the peer-generated screencasts online and provided feedback. The students' learning outcomes, including their CAD modeling skills, engineering attitude, and their life-long learning skills, are assessed. In addition, experimental group students completed an exit survey that explored their experiences. Selected students in the experimental groups were interviewed. We used quantitative tests to analyze all the data collected.

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Poster Category: STEM Research

A Biomass-to-Liquid Fuel Refinery based on Gasification and Fisher-Tropsch Synthesis

Lijun Wang, North Carolina Agricultural and Technical State University
Co-Author(s): John Eshun and Mohammad Rafati, Department of Energy and Environmental Systems, North Carolina Agricultural and Technical State University
Talal Ahmed, Department of Nanoengineering, North Carolina

Agricultural and Technical State University
Abolhasan Hashemisohi, Department of Computational Science and Engineering, North Carolina Agricultural and Technical State University
Lijun Wang, Abolghasem Shahbazi, and Anton Pylypenko, Biological Engineering Program, Department of Natural Resources and Environmental Design, North Carolina Agricultural and Technical State University

The combination of biomass gasification and subsequent Fischer–Tropsch (FT) synthesis is a promising pathway to produce liquid fuels and chemicals as alternatives to fossil-based counterparts. Biomass gasification in a fluidized bed gasifier involves complicated physicochemical and structure evolution of biomass particles, and reactive gas-particle behavior. The impurities in syngas such as nitrogen and tar can severely interfere with downstream catalytic reactions using the syngas. Syngas produced through biomass gasification contains a significant amount of CO2. This project is thus to study an integrated biomass gasification and FT synthetic process to produce liquid fuels from biomass. Five studies have been conducted, which include: (1) experimental determination and mathematical modeling of physicochemical and structural evolution of biomass particles during gasification; (2) computational fluid dynamics (CFD) modeling of the multiphase reactive gas-particle flow behavior in a biomass fluidized bed gasifier; (3) investigation of a nickel-based catalyst for tar cracking and ammonia decomposition of hot syngas; (4) study of Fe-based catalyst for the F-T synthesis of liquid fuels from biomass-derived syngas with a significant amount of CO2; and (5) process simulation of the biomass-to-liquid fuel refinery.

Advanced experimental and mathematical modeling techniques are used to generate fundamental knowledge and tools necessary for the development of a biomass-to-liquid fuel refinery based on gasification and FT synthesis. Specifically, experimental techniques including thermogravimetry, differential scanning calorimetry, Frontier micropyrolyzer, elemental analyzer, gas chromatograph, mass spectrometry and infrared spectrometry are used to uncover the physicochemical evolution of biomass particles during gasification. The evolution of the porous structure of biomass particles is analyzed using a B.E.T. surface area and pore analyzer. A CFD model with temperature-dependent physicochemical and structural properties is developed to analyze the behavior of multiple-phase, reactive gas-particle flow in a biomass fluidized bed gasifier. Different nickel-based catalysts are investigated to catalytically remove tar and ammonia from the syngas. The effect of promoting Fe-based F-T catalysts with various metals in hydrogenation of biomass-derived syngas is studied. A mathematical model is developed in Aspen Plus and Gabi 6 to analyze the techno-economics and assess the environmental impacts of the refinery.

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Poster Category: STEM Research

Development of Knowledge-Based System for Integrating Artificial Intelligence into the Undergraduate Engineering Curriculum

Yaqi Wanyan, Texas Southern University
Co-Author(s): David Olowokere and Xuemin Chen, Texas Southern University

This project seeks to infuse innovative electrical/computer engineering specialized Artificial Intelligence (AI) tools into traditional engineering problem-solving routines by problem-based learning (PBL) approach to bridge current curricula gap in the Department of Engineering at Texas Southern University (TSU). Two newly implemented undergraduate engineering programs of the Department are Civil Engineering (CE) and Electrical and Computer Engineering (ECE). Currently, junior and senior CE curriculum (300 and 400 level) focus exclusively on conventional mathematics, physics, and/or engineering methods for core engineering design and analysis courses, and these classical curricula are highly specialized into different sub disciplines such as environmental engineering, transportation engineering, structural engineering and construction engineering and management. On the other hand, ECE major students learn AI theories and algorithms in depth but lack real case engineering applications in their curriculum to fully appreciate the knowledge they are learning. The overall goal is to fill the gap by developing new technology rich curricula to increase students' awareness of the need for the knowledge, which in return enhances the learning outcome. There are five key objectives: 1) Develop an interactive and comprehensive intelligent database to document, compare, and analyze cutting-edge AI applications in CE field and use it as the platform and educational media for curricula development and implementation; 2) Develop one new interdisciplinary curriculum 'AI Tools for Engineering Problem Solving' for both CE and ECE students as senior elective course; 3) Enrich current curricula by integrating innovative AI application case studies into twelve existing CE junior and senior level courses; and adopting knowledge automation software into one existing senior ECE course; 4) Foster interdisciplinary academic setting by hosting server-based intelligent database and provide web- and classroom-based workshops and tutorials for all interested students and faculty; 5) Support undergraduate students' early involvement in research. The project activities will impact more than 400 under-represented minority undergraduate students in the Department of Engineering to promote learning interests, stimulate cognitive process, emphasis underlying engineering problem-solving activities, enhance academic infrastructure and

to foster an interdisciplinary setting that reflects the multi-disciplinary nature of many engineering processes. The infusion of innovative theories and practical applications will improve engineering students' critical thinking skills, thus better prepare them as competent engineers. The proposed activities will also have a significant impact on how new technologies are taught in old-fashioned engineering field such as civil engineering and how students learn these concepts.

Funder Acknowledgement: NSF HBCU-UP Targeted Infusion Award HRD1533569

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Poster Category: STEM Research

Small Molecule Inhibitors of the Phosphoenolpyruvate-Phosphotransferase System

Patrick Ymele-Leki, Howard University

The phosphoenolpyruvate-carbohydrate phosphotransferase system (PTS) is a multistep chemical process that regulates the intake and use of carbohydrates by bacteria. The PTS also regulates several cellular functions such as chemotaxis, catabolite repression and biofilm formation. A biofilm is occurs when bacteria form a layer of microbial cells that grow attached to one another and to a surface. Biofilm formation causes problems in many branches of industry, including the medical and food process industries, as well as industrial water systems.

This research hypothesizes that given the established connection between PTS activity and biofilm formation in bacterial species, the identification of small-molecule that can interfere with PTS activity will suggest new tools and approaches for the control of microbial biofilms. Thus, a screening assay for bacterial fermentation of carbohydrates by Vibrio cholerae was developed to identify chemical compounds that will interfere with PTS transport. For the screen, a V. cholerae O139 strain, MO10, growing in the absence of chemical compounds served as a negative compound. An altered strain, which lacked PTS activity, served as a positive control. Chemical compounds were selected for their physiochemical properties, such as solubility, decreased toxicity, and increased stability. Data suggests that several compounds screened exhibit bactericidal activity while others interfere with the ability of Vibrio to ferment sugars. This interference may occur through direct interaction with the PTS and will be further investigated. Success of this project will result in the identification and characterization of antimicrobial compounds that inhibit the bacterial PTS system and regulate biofilm formation. This may lead to the development of novel microbial control strategies with applications in engineering, physical, biological, medical, and pharmaceutical sciences.

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Poster Category: STEM Research

Initiation of Research and Educational Program in Computational Nanomechanics and Nanoscale Testing at Tuskegee University

Shaik Zainuddin, Tuskegee University
Co-Author(s): Amari Carter, Farooq Syed, Mackenzie Matthews, and Desmond Larkins

Through the HBCU-UP Research Initiation Award Grant, the Department of Materials Science and Engineering (MSE) at Tuskegee University (TU) developed its research capabilities in Computational Nanomechanics and Nanoscale Testing. These areas of research are essential to the development of a deeper understanding of the interaction of nano fillers with the matrix materials and their role in enhancing the mechanical properties of composite structures. The specific activities performed through this grant include: 1) Setting up the initial structure with various amount of cross-linking between SWCNT and Epon molecule and with a varying diameters of SWCNT, 2) Determination of interfacial binding energy and frictional stresses between carboxylic (COOH) functionalized SWCNT and Epon composites, 3) Measurement of frictional stresses as a function of the density of chemical bonds between COOH-SWCNT and Epon composites, 4) Quantification of how these stresses scale with the surface area of COOH-SWCNT, 5) Determination of interfacial strength using fiber pull-out and nanoindentation tests to compare the trends in shear strength with respect to SWCNT size and density of interfacial bonds observed in MD simulations, and 6) Involve undergraduate students in this research. Development of atomistic computational models and experiments at the nanoscale provided significant knowledge about the behavior of advanced composite materials that can be used in a variety of applications. The knowledge developed through this research project benefitted the ongoing research projects in MSE, while enhancing the research and mentoring capabilities of the PI. This also allowed TU to introduce new research area and academic course to prepare students. In addition, this enhanced capability also broadened the areas of research for students involved in the research and educational activities of the MSE department. We will, therefore, be able to recruit and graduate a larger number of African American students at the undergraduate levels who can be mentored to pursue graduate studies. These graduates will help bring much-needed diversity to the nation's advanced technological workforce.

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Poster Category: STEM Research

Understanding Fiber-Fiber Interaction in Fiber-Reinforced Composite Materials Processing

Dongdong Zhang, Prairie View A&M University
Co-Author(s): Douglas E. Smith, Baylor University, Baylor, TX
Clifford Abendanio and Carl Upchurch, Prairie View A&M University, Prairie View, TX

Fiber reinforced polymer composite materials, well-known for high strength-to-weight ratio, are widely used in various industries such as aerospace and automotive fields. Fiber reinforced polymer composite products are widespread since they can be manufactured into complicated shapes with improved properties obtained by adding carbon or glass fibers into the polymer matrix. The current models widely used in commercial software (e.g. Moldflow, Autodesk, Inc.) to predict fiber orientation during the injection molding process is based on Jeffery's pivotal work and the tensor approach. However, the current models always over-predict fiber orientation, which cannot be used to obtain the desired engineered products. Meanwhile, the current model cannot predict the deformation of long fibers, which greatly affects the properties of final products. In this poster, the physical understanding of fiber-fiber interaction is achieved. With the large-scale finite element based simulation tool, the correlation between the change of fiber orientation and fiber-fiber interaction are established. The correlation is established as the number of surrounding fibers increases and the separation between fibers' centroids varies. The method of using closed bounded fluid domain to approximate the concentrated fiber suspension is also introduced in this poster.

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Poster Category: STEM Research

Principle Component Analysis and K-means Classification of Infrared Photothermal Imaging of Trace Explosives on Relevant Substrates

Nian Zhang, University of the District of Columbia

The goal of this project is to analyze the noise-free but highly overlapped and imbalanced data set involving trace explosives. The objective is to develop algorithms to discover the underlying mechanism that affect the clustering performance on different combination of principal components and different number of features. In this project, we explored the principle components in the feature space to observe which spectral bands contribute the most contrast or data spreading. We also compared the principal component analysis (PCA) results and the corresponding k-means clustering algorithm results generated using lower PCs, i.e. PC4 and PC5 to see how it compares to using a combination of top PCs, i.e. PC1 and PC2. Specifically, we reveal the data in PC1-PC2 space, PC1-PC3 space, PC2-PC3 space, and PC4-PC5 space, respectively. Then we used the K-mean clustering algorithm to classify them into six classes including TNT, DNT, PE, PC, RDX, and Copper/Steel. We developed an algorithm to automatically determine the classifiers associated with each clustering. The algorithm can accurately determine which clustering corresponds to which analyte. To enhance the visualization efficiency, the same color code is used in the k-means algorithm as the PCA, for example, red represents TNT, green represents DNT, yellow represents PE, cyan represents PC, blue represents RDX, and black represents copper/steel. In this way, we can effectively compare the PCA and the k-means clustering results. We also conducted the clustering performance evaluation by calculating the probability of detection (POD), false alarm rate (FAR), accuracy, precision, and recall. This process was facilitated by developing an automatic algorithm to determine the true positive (TP), false negative (FN), false positive (FP), and true negative (TN), which are components of the above performance evaluation matrices. In addition, we compared the clustering abilities with different combination of principal components. Moreover, we investigated the false alarms to see if they are always the same samples, and if so, which ones. Furthermore, we investigated the effect of the first 28 features on the PCA and k-means algorithm with different combination of principal components. The experimental results demonstrated that top principal components (PCs) have higher clustering accuracy than the lower PCs.

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Poster Category: STEM Research

Demographic Shift and its Potential Effect on Engineering Technology

Yongpeng Zhang, Prairie View A&M University

With the aging of baby boomers, which represent 76 million people in the United States or 1/4 of the overall population in this country, it creates wide-ranging implications for virtually every facet of American society. On par with the aging baby

boomers is the growing minority population. In the past decade, Hispanics grew by 15 million people. The African-American and Asian-American populations each increased by more than 4 million. Non-Hispanic whites made up 75% of the population in 1990, its proportion dropped to about 70% in 2000, and further down to 63% in 2012. If the changing trend continues as of the past two decades, non-Hispanic whites will be outnumbered by minorities in 2035. Today in many places including the densely populated states of California and Texas, non-Hispanic whites have already been in the minority. The momentous demographic shift of United States has and will continue to have a dramatic effect on business, lifestyle, and culture. For the children under age 18 nationwide, this minority-to-majority flip will happen soon. In Texas, the 2014 high school graduation seniors will be the last crop without a majority of Hispanic students, probably they are also the last without a majority of students from financial disadvantageous background. And the bulk of minority students especially Hispanics are further concentrated in the younger grades. Research indicates that there is a connection between parents' socio-economic status and their children's achievements in education and profession, consequently the social and economic disparities are often passed onto the next generation. As many minority students value education and perform very well academically and socially, many other families do not have access to information about the educational system in a way that helps support their children to be successful in the U.S. school system. In Texas, Latino children drop in 12-th grade at 35%, significantly higher than other groups. Among Hispanic students graduated from high school, few are prepared for college. In 2011, only 42% met college readiness benchmarks in both English and Math, compared with 65% of Anglo students. The gap is further widen among economically disadvantaged students that only 38% are qualified as 'college ready' in the college entrance exams. Today, completing a higher education not only means the enhancement of social status, but also means a better financial capability in the computerized society. Compared with high school graduates, bachelor degree recipients lifetime earning is 65% higher; associate degree recipients lifetime earning is 27% higher. In addition, the unemployment rate for individuals with at least a bachelor's degree has consistently been about half the unemployment rate for high school graduates. It indicates employees completed higher education with current technical skills and lifelong learning capability are much more valuable to the employers and in return, could command higher levels of compensation and stability. With increasing recognition of higher education, minority student postsecondary enrollment also achieved a steady increase in the past several decades. Considering the rapid minority population growth and minority-majority flip tendency, the significance of young minorities for the growth and vitality of our labor force and economy need to be particularly recognized. When an economic underclass becomes the majority, the class division between the embarrassingly wealthy and the unacceptably poor not only caused alienation, resentment, and social unrest, but also will affect the sustainability of economical prosperity.

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Poster Category: STEM Science and Mathematics Education

Teaching Community Approach to Prompting Effective Active Learning through Implementing Self-Regulated Learning Assessment in Multiple STEM Courses

Wei Zheng, Jackson State University

Learners not only have to manage the motivation to sustain their learning efforts, but also need to strategically regulate their cognitive activities in order to effectively acquire knowledge. Educational research has provided understanding on effective Self-Regulated Learning (SRL) and revealed that optimal learning is strongly correlated to the extent to which the learner uses SRL. However, those findings have not been well known and utilized by the STEM faculty members to facilitate learning of their students, particularly those African American students who had poor preparation in their early schooling and may mostly need the SRL skills for comprehending complex STEM subjects. This poster is intended to communicate a novel perspective for prompting STEM faculty to acquire SRL and other learning theories and prompting students to develop higher-order learning skills, and presents work-in-progress of implementation of a proposed framework in this perspective, which is the main implementation framework of a NSF-funded Target Infusion Project. The objectives of implementing the presented framework to expand faculty's expertise in fostering students' active learning through their participation in a teaching community and interaction with learning scientists; and to facilitate students' SRL skill development in their STEM learning by implementing the SRL Assessment in diverse STEM courses. The SRL assessment is composed of various questions that prompt students to make plans, adopt learning strategies, reflect on their learning efforts, and make adjustments on their learning efforts. It is implemented through integration with series of course quizzes in repeated cyclic processes for fostering students' SRL skills. Through such guided learning processes, students can have the opportunity to learn, adopt, and practice different learning strategies, and track and assess more effectively their academic learning, make adjustment for improvement, leading to enhancement of their academic performance, as well as their self-confidence and self-regulation skill. The novelty of the presented framework lies in building a broad teaching community among STEM instructors and learning scientists, whose members can provide the peer support to acquire learning theories and design, implement, evaluate, and publish their effective teaching practice in implementing SRL Assessment through intellectual exchange

based on their common interest and pursuit. This novelty enables STEM instructors to adapt or develop learning strategies that are particularly suitable for a specific STEM subject in their courses, and enables students to be prompted for learning, adopting, and evaluating various regulating strategies in context of learning subjects from multiple STEM courses simultaneously. The mixed-methods with quasi-experimental design are also developed to collect and analyze data for revealing the impacts of SRL assessment on African American students' learning in STEM fields. This poster presents the proposed framework including teaching community activity plan and SRL assessment implementation procedures, the work-in-progress of data collection on students' learning dispositions, and future improvement and work on implementation of the presented framework.

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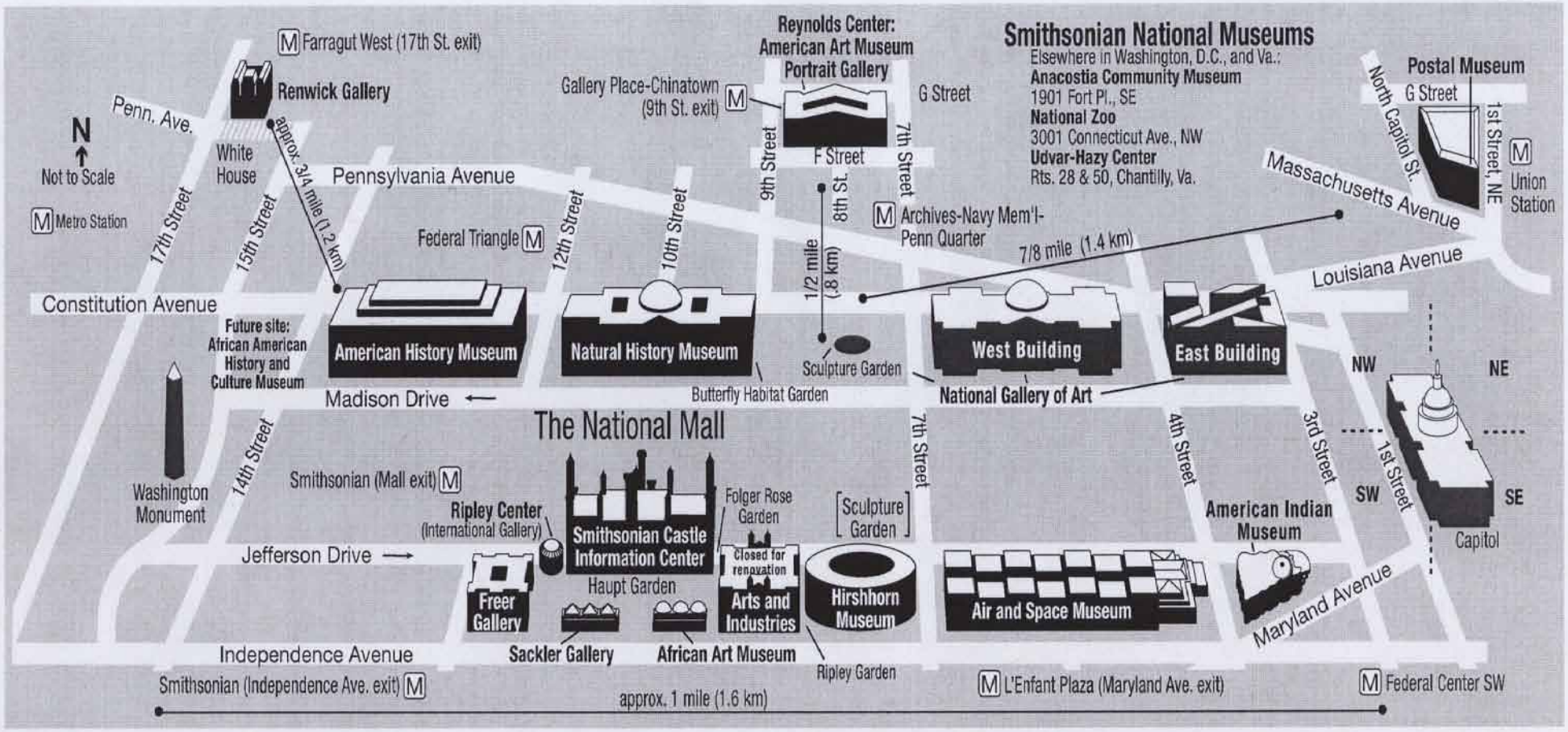

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