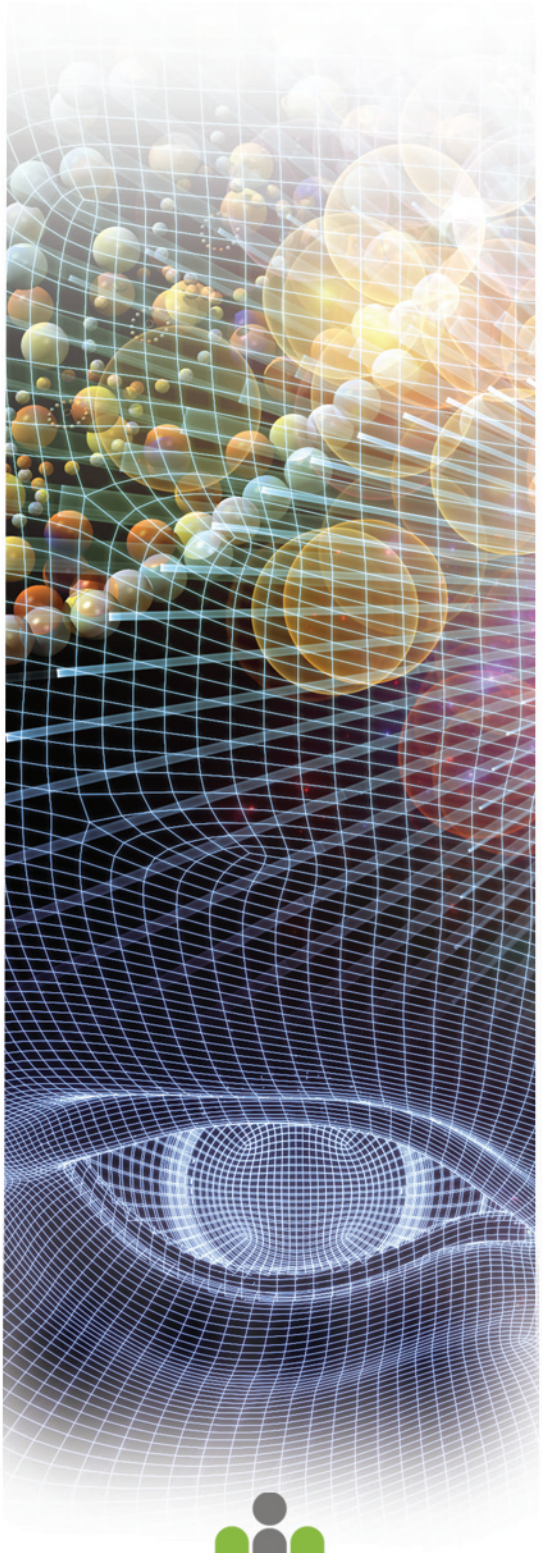
UNDERSTANDING INTERVENTIONS

THAT BROADEN PARTICIPATION IN SCIENCE CAREERS

San Diego, CA



UNDERSTANDING INTERVENTIONS

MAY 15th - 17th

TRANSLATING RESEARCH, IMPACTING PRACTICE

2015

7th CONFERENCE ON

UNDERSTANDING INTERVENTIONS

That Broaden Participation in Science Careers

May 15 – 17, 2015

The Westin San Diego
San Diego, California

Anthony L. DePass and Daryl E. Chubin, Co-chairs

[www.understanding-interventions.org]

FUNDING AND SUPPORT

Over the years, this effort has benefited from generous support from the National Institutes of Health, the National Science Foundation, the Alfred P. Sloan Foundation, Howard Hughes Medical Institute, and Educational Testing Service. We have also enjoyed productive collaborations with the National Academy of Sciences, American Society for Cell Biology, the American Society of Plant Biologists, American Association for the Advancement of Science, and Long Island University.

In September 2013, a NIGMS T36 MARC grant from the National Institutes of Health (Grant No.1 T36 GM 102000) was awarded to Long Island University and it currently provides long-term support for the following:

Organization of conferences that will provide: a) venues for dissemination of interventions research and related training; b) opportunities for researchers/practitioners to interact and collaborate; and c) a mechanism for discourse on research-based interventions' implementation across modalities, stages, and venues. A monograph will be published that captures the proceedings of each annual conference.

An enhanced and interactive Understanding Interventions website that will: a) facilitate linkages among members of the Understanding Interventions (UI) community; and b) feature an accessible and searchable internet-based annotated database of Interventions articles and other resources. This will expand the dissemination of broadening participation research.

An online/email-based publication that distills and disseminates research findings, development opportunities, and general announcements to provide an additional platform for growth of the Understanding Interventions community. Social/behavioral sciences, student affairs, and professional societies and organizations such as American Association of University Professors, American Association of State Colleges and Universities, and Association of American Universities that influence higher education will be added to the annual list and receive the newsletter.

We would like to extend our sincere appreciation to the National Institutes of Health for considerable investment that has been made in providing a stable base for our operations. We also thank the National Science Foundation and especially Dr. Claudia Rankins for their support for this conference and its related activities. We also thank Drs. David Asai, Elizabeth Boylan, and Michael Nettles from respectively, Howard Hughes Medical Institute, The Alfred P. Sloan Foundation, and Educational Testing Service for their generous support of UI activities.

To all our collaborators, and participants, thank you for your generous contributions to this very important work.

WELCOME

We are delighted to welcome you to San Diego, the site of the 2015 Conference on Understanding Interventions that Broaden Participation in Science Careers. This 7th conference marks a new epoch in the movement of this growing community, something that this year's attendees—about half of those who participated in the 6th conference—will recognize.

Understanding Interventions—the practice of interventions, of scholarship, and of policy implementation—requires a combination of expertise and experience. For our unity of purpose can only be attained through an exchange of knowledge across boundaries of "difference" in disciplines, cultures, and organizations.

The program features a variety of topics and formats under the umbrella of "Translating Research, Impacting Practice." Through 10 workshops, four plenary sessions, more than a dozen symposia, and over 40 poster presentations, we will explore science interventions together over 2.5 intense days. This work will continue through interactions on the redesigned and expanded UI website, www.understanding-interventions.org.

The 7th Understanding Interventions conference launches the next phase in this community's collaborations to discover, synthesize, fill gaps, and assist those renewing the science workforce through inventive programs of research, education, and training. This is the community you have joined and enriched.

Thank you for joining us in San Diego. We are honored by your participation.

Anthony L. DePass and Daryl E. Chubin, Co-Chairs

Conference Cover: Carol McDonald, Barefoot Creations
Program Design: Shanta Outlaw, Long Island University
Conference Website: http://www.understanding-interventions.org

ACKNOWLEDGEMENTS

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7th CONFERENCE ON UNDERSTANDING INTERVENTIONS THAT BROADEN PARTICIPATION IN SCIENCE CAREERS
May 15-17, 2015
San Diego, CA

"Translating Research, Impacting Practice"

PROGRAM AGENDA

Friday, May 15, 2015

9:00 am - 7:00 pm	**Registration Open** BALLROOM FOYER, SECOND FLOOR
10:00 am - 4: 30 pm	**Concurrent Workshops** *(Abstracts Begin on Page 14)*
10:00 am – 11:30 am	W01: Characteristics of Excellence in Undergraduate Research: A Framework for Best Practices DIAMOND ROOM II
10:00 am – 11:30 am	W02: Understanding Interventions Index: A Resource for Scholars, Evaluators, Program Directors, Policymakers, and Students TOPAZ ROOM
10:00 am – 1:00 pm	W03: Student Mentoring in Community Colleges DIAMOND ROOM I
11:30 am–12:00 pm	**New Attendee Orientation: What's UI All About?** OPAL ROOM
1:00 pm – 2:00 pm	W04: The Meyerhoff Scholars Program: Changing Minds, Transforming a Campus TOPAZ ROOM
1:00 pm – 2:30 pm	W05: Harnessing the Power of Longitudinal Qualitative Data DIAMOND ROOM II
1:00 pm – 4:00 pm	W06: Success Strategies for Women in STEM: A Portable Mentor OPAL ROOM
2:15 pm -2:45 pm	**New Attendee Orientation: What's UI All About?** TOPAZ ROOM

3:00 pm – 4:30 pm	W07: National Research Mentoring Network: "Steps Toward Academic Research" Fellowship Program (NRMN STAR) DIAMOND ROOM II
3:00 pm – 4:30 pm	W08: Evaluation as a tool to Strengthening Programs: A Primer for the Non Evaluator TOPAZ ROOM
3:00 pm – 4:30 pm	W09: NSF INCLUDES: Empowering All Youth for STEM DIAMOND ROOM I
5:00 pm	**Welcome and Opening Plenary** EMERALD BALLROOM
	Welcome *Anthony L. DePass and Daryl E. Chubin*
	Scientific Workforce Diversity: Opportunity for Enhancing Research Excellence **Presenter** *Hannah Valantine, MD, National Institutes of Health*
7:00-8:00 pm	**Reception** CRYSTAL BALLROOM

Saturday, May 16, 2015

7:00 am – 5:00 pm	**Conference Registration and Information** BALLROOM FOYER
7:30 am – 8:30 am	**Breakfast Buffet** EMERALD BALLROOM
8:30 am -10:15 am	**Plenary II:** EMERALD BALLROOM
	Are We Measuring and Interpreting What We Value about Programs? **Presenters** *Clifton Poodry, Howard Hughes Medical Institute* *Kelly Mack, Project Kaleidoscope* *Daryl E. Chubin, Independent Consultant* *Anthony L. DePass, Long Island University*
10:15 am – 10:30 am	**Refreshment Break** BALLROOM FOYER

10:30 am-12:00 pm **Concurrent Symposia I**

(Abstracts Begin on Page 49)

S01: Strengths-based STEM Interventions for Underrepresented Students: Understanding Strong Program Elements and Student Barriers

Chair: Phillip J. Bowman

DIAMOND BALLROOM I

Strengths-based STEM Interventions: Meyerhoff Scholars Program and Beyond

Kenneth Maton

Formal Organizational Support and STEM Intervention Outcomes: A Strengths-based Approach

TaShara Bailey

Financial and Academic Barriers to STEM Intervention Success

Krystal Williams

S02: Promising Models to Promote STEM Research Careers by Multi-Institution, Multi-Disciplinary Alliances Funded by the NSF AGEP-T Program

Chair: Mohammed A. Qazi

DIAMOND BALLROOM II

The Tuskegee Alliance to Forge Pathways to Academic Careers in STEM (T-PAC)

Melody L. Russell, B. K. Robertson, and Shaik Jeelani

AGEP-T Frontiers of Research and Academic Models of Excellence (FRAME): Bridging Research and Practice to Promote Academic Engagement of Underrepresented Minorities in STEM Fields

Sheri Clark

The Next Generation of Scholars: Recruiting and Retaining URM STEM Graduate Students

Rhonda Fowler

S03: 2- to 4-Year College Transition

Chair: Kelly Mack

TOPAZ ROOM

Factors Influencing the Persistence of Students Enrolled in STEM Programs at Historically Black Community Colleges

Latitia McCane

URM Students are the Majority in a Hybrid Online B.S. Degree Program from a Research-intensive University
Jennifer C. Drew

12:00 pm -1:30 pm **Luncheon and Plenary III**
EMERALD BALLROOM

Student Transitions from 2- to 4-Year Institutions
Moderator: Anthony L. DePass

Shifting Students' Stereotypes of Scientists to Enhance Science Identity in a Diverse, Community College Context
Jeff Schinske

Hostos Community College-The City University of New York Joint Dual Engineering Degree Program: A Successful Marriage
Yoel Rodríguez

1:45 pm -3:00 pm **Concurrent Symposia II**

S04: Taking the Next Step: Examining Obstacles and Opportunities in STEM Career Pathways
Chair: Clifton Poodry
DIAMOND BALLROOM I

Taking the Next Step: Examining Obstacles and Opportunities in STEM Career Pathways
Christopher B. Newman

Career Development during Graduate and Postdoctoral Training
Kimberly Griffin and Kenneth Gibbs

The Role of Undergraduate Research in Developing a STEM Identity among Women Scientists of Color
Tonisha B. Lane

S05: Strategies with Undergraduates I
Chair: Shiva Singh
DIAMOND BALLROOM II

Integrated Programs Support Success and Graduation
Patricia A. Marsteller

Closing the Social Class Achievement Gap in Undergraduate Biology Courses with Values Affirmation Interventions
Yoi Tibbetts

Closing Achievement Gaps with Utility Value Interventions
Judith Harackiewicz

S06: Enhancing Success for Post Baccalaureates and Graduate Students
Chair: Richard McGee
OPAL ROOM

Transforming PREP Outcomes through Changes in Mentoring Approach
John David

Transformational Impact of IMSD on Institutional Models for Recruitment and Graduate Training.
Nicquet M.J. Blake

3:00 pm – 3:15 pm **Refreshment Break**
BALLROOM FOYER

3:15 pm - 4:45 pm **Concurrent Symposia III**

S07: Barriers and Solutions to Advancing Careers
Chair: John Matsui
DIAMOND BALLROOM I

Perceived Academic Career Coach Effectiveness by Coaching Style among Biomedical PhD Students
Veronica Y. Womack

Benefits of the Academy Coaching Intervention on Perceptions of Academic Career Success
Bhoomi K. Thakore

Latina STEM Pathways to the Professoriate: Findings from President's Postdoctoral Fellowship Program Interview Study
Yvette Flores

S08: Psychological Factors in Student Performance
Chair: Mona Trempe
DIAMOND BALLROOM II

Diversifying Science: Programs Weaken the Effect of Chronic Stereotype Threat on Maladaptive Achievement Goals
Anna Woodcock

Latina Resiliency: Dealing with Contextual Mitigating Factors in Pursuit of STEM Careers
Alejandro J. Gallard

Cooperative Online Learning Tools for Middle School Science: Lessons Learned from a Design-based Research Study
Fatima E. Terrazas-Arellanes

S09: Institutional Case Studies
Chair: Claudia Rankins
TOPAZ ROOM

Inclusive Chemistry Success Project
Rebecca Ciancanelli

Factors that Predict Interest in Pursuing Research Careers Among URM Students
Erin Banks

Common Denominators for Successful STEM Graduate School Preparation in the School of Engineering and the School of Computer, Mathematics and Natural Sciences at Morgan State University
Christine F. Hohmann

S10: Career Preparation: Research and Practice
Chair: Laura Robles
OPAL ROOM

Addressing the Intersectionality of Underrepresentation and STEM Identity through Holistic Professional Development for Graduate Students and Postdocs
Renetta Garrison Tull

The Evolution of Career Intentions of Biomedical PhD Students: A Longitudinal Qualitative Study of a Diverse Population
Christine Wood

Toward a Career-Specific Developmental Model for African Americans in STEM
LaVar J. Charleston

5:00 pm -7:00 pm **Poster Session/Reception**
CRYSTAL BALLROOM
(Abstracts Begin on Page 20)

Sunday, May 17, 2015

7:30 am - 8:30 am **Breakfast**
EMERALD BALLROOM

8:30 am -10:00am **Plenary IV**
EMERALD BALLROOM

The Importance of Understanding Human Behavior: Stereotype Threat and Implicit Bias in the Academy and in Business
Presenter
Lydia Villa-Komaroff, Cytonome/ST

10:15 am -11:45am **Concurrent Symposia IV**

S11: National Networks with a Disciplinary Focus
Chair: Alberto Roca
DIAMOND BALLROOM I

Erasing the Achievement Gap in Graduate Education for Underrepresented Students: Bridge Programs Run by Professional Societies
Theodore Hodapp

Re-assessing What Works: A Novel Approach to Measuring Efficacy and Early Findings from a Broad Intervention Partnership
Mark A. Lawson

Defining the Quantitative and Computational Skills of Incoming Biology Students
Paul J. Overvoorde

S12: Strategies with Undergraduates II
Chair: Richard McGee
DIAMOND BALLROOM II

How to Integrate Sustainability Concerns into Retention Strategies of Minority Engineering Students through Experiential Learning Interventions
Imelda Olague-Caballero

Interventions that Work (and Some That Do Not)
Keith H. Pannell

Disciplinary First-Year Seminar Tackles the Achievement Gap
Caroline Jakuba Wienhold

S13: Student Pipelines and Teacher Training
Chair: LaVar Charleston
TOPAZ ROOM

Blended Learning Strategies in Teaching Mixed Method Research to School Teachers
Echo H. Wu

The Institute on Neuroscience (ION) Summer Research Program for Outstanding High School Students and Teachers
Chris Goode

The Loma Linda University Health Disparities Research Pipeline Program: Best Practices, Outcomes and institutional Impact
Marino De Leon

S14: First Generation Graduate Students
Chair: Barry Komisaruk
OPAL ROOM

Can Interventions Change the Decline in First Generation Doctorate Recipients in STEM?
Anne J. MacLachlan

'First-Generation' Graduate Students and Postdocs: Yes, They Exist and You Should Pay Attention!
Carrie Cameron

11:45 am – 12:00 pm **Refreshment Break**
BALLROOM FOYER

12:00 pm -12:30 pm **Closing Session**
EMERALD BALLROOM

Workshop Abstracts

W01: Characteristics of Excellence in Undergraduate Research: A Framework for Best Practices

Linda Blockus—University of Missouri

"Characteristics of Excellence in Undergraduate Research" (COEUR), developed by the Council on Undergraduate Research (CUR), is a summary of best practices that support and sustain highly effective undergraduate research environments at all types of institutions. COEUR is organized in sections that correspond to various functions or units of a typical college or university campus. In CUR's experience, successful programs exhibit many of the characteristics enumerated in this document. Further, many of the characteristics described in this document overlap and are important elements in an integrated, synergistic approach to enhancing undergraduate research.

This workshop will walk participants through the 12 sections and along the way ask participants to evaluate successes and challenges related to those sections in their own institutional or programmatic context. Participants will then be organized into smaller groups to discuss common interests and challenges identified in COEUR. Suggestions on how participants might utilize COEUR on their campus to frame discussions and leverage change will be discussed.

Information on resources that CUR can provide will be shared along with information on a new annual award, the CUR Campus-wide Award for Undergraduate Research Accomplishments (AURA). This award recognizes higher-education institutions that have both successfully implemented some of the characteristics of excellence and have devised exemplary programs to provide high-quality research experiences to undergraduates. The depth and breadth of the institutional commitment to undergraduate research as well as the innovative nature of a sustained, exemplary program are important criteria for award selection.

Undergraduate research experiences are a common intervention activity and a necessary professional/scientific development experience for students to successfully pursue an advanced research degree. The COEUR summary provides a framework for institutions and programs to discuss and self-evaluate the extent to which their environment supports this high impact educational practice. Of specific interest to UI attendees will be sections on administrative support, professional development, student-centered issues, curriculum, summer research programs, and assessment. Additionally, program directors and proposal reviewers may wish to utilize this framework to develop and review grant proposals that involve undergraduate research components. Intervention researchers may find COEUR helpful in framing the components of undergraduate research as an intervention. Additional information and a free download of COEUR can be found at http://www.cur.org/publications/publication_listings/coeur/

W02: Understanding Interventions Index: A Resource for Scholars, Evaluators, Program Directors, Policymakers, and Students

Angela Ebreo and Phillip J. Bowman—both of University of Michigan; Daryl E. Chubin—Independent Consultant; and Anthony L. DePass—Long Island University

This two-part 90 minute workshop will provide an overview of the construction of the Understanding Interventions Index, an annotated bibliography that will be integrated into the Understanding Interventions website. The Bibliography is intended to be a non-exhaustive resource for members of the UI community, providing: background information about broadening participation and diversity efforts, citations related to recent and significant scholarship related to research career interventions, and access to salient policy-relevant reports and existing bibliographies. Workshop participants will be introduced to various aspects of the Index, covering

what content will be available, how it can be used, and who might apply it to their work. In addition, participants will have the opportunity to contribute to the development of the Index by proposing keywords, search terms, and topic descriptors that will facilitate online interrogation of the database.

In the first part of the workshop, the presenters will offer background on the origins of this initiative. Following this brief historical introduction, the presenters will describe the proposed content for this resource, including its organization. Current plans for the bibliography include three major sections: a) existing bibliographies; b) policy-relevant reports, and c) scholarly publications. A general description of the content that will introduce each of the major sections will be shared, along with the rationale for the systematic selection of initial material that will appear in each section. The presenters will also discuss their plans for adding content, including strategies for conducting searches of academic databases. Presenters will also share the methodology used for identifying Index content, given the multidisciplinary and interdisciplinary nature of UI work

The second part of the workshop will be designed to elicit feedback and suggestions for improving the utility of the Index to various members of the UI community. Workshop participants will engage in small group discussion of the search capabilities of each section of three sections of the bibliography (i.e., existing bibliographies, reports, and scholarly publications). The small groups will be presented with the keywords proposed to search the database. Due to the various citation conventions and terms for concepts used by persons/organizations representing different disciplines, participants will have the opportunity to critique and recommend additional key terms to facilitate the retrieval of information.

W03: Student Mentoring in Community College

Eugenia Paulus and Michael Birchard—both of North Hennepin Community College

In the Gallup-Purdue Index Report, supported by Lumina and published in May 2014, involving a study of more than 30,000 college students across the U.S., and providing insight into the relationship between students and their college experience, students who felt supported in college because they had a mentor who encouraged them to pursue their goals and dreams are thriving in all areas of their well-being. The patterns of participation in postsecondary education are very much shaped by race and sex; underrepresented women and minorities are more heavily concentrated in community colleges. An article on STEM persistence highlights the crucial role of undergraduate institutional faculty and peer interactions among women and minorities for their successful graduation from the community college. These students need mentoring; they need a mentor to help them stay in college, to persist, to complete and perhaps even to move on to higher education.

This workshop aims at sharing mentoring strategies that have been used with success at the community college. Mentoring potentially starts the day that the course commences. The mentor-mentee relationship is established when the student sits down with the mentor and discusses personal goals. The first task is to create a Plan A and a Plan B, with a timeline. Underrepresented students may need assistance with preparation for the program of their interest and experienced alumni mentors can help students with planning and organization towards their goal. Successful peers can help students in several ways. They may provide advice on classes to take or pathways to follow, offer information on available resources or methods of study and they can act as a role model or a personal coach. The educator who is involved in mentoring may help the mentee with resume writing, presentation skills, writing skills, pre-professional exam guidance and networking. These are often some of the most challenging skills for a community college student to acquire and yet they are the most desired proficiencies in the academic and workforce environment today.

W04: The Meyerhoff Scholars Program: Changing Minds, Transforming a Campus

Diane Lee, Keith Harmon, and Mitsue Wiggs—all of University of Maryland, Baltimore County

The Meyerhoff Scholars Program, established in 1988, has been at the forefront of efforts to increase diversity among future leaders in science, technology, engineering, and mathematics (STEM). The major achievements in recruiting and graduating African American students in STEM at one of the highest rates among the nation's institutions of higher education is built on the premise that, by assembling a strong concentration of high-achieving students in a tightly knit learning community, students continually inspire one another to excel in this strengths-based approach. Building on this underlying principle is the assumption that every affiliated student is capable of succeeding in STEM when given appropriate opportunities and resources. This concept and university commitment has ignited major institutional transformation and systemic change at the University of Maryland, Baltimore County (UMBC). The programmatic additions scaled for the campus community include the Collegiate Success Institute (CSI) Summer Bridge Program, First Year Seminars (FYS), Introduction to Honors University (IHU), Transfer Student Seminars (TRS), Living Learning Communities (LLC), New Student Book Experience, Supplemental Instruction (SI), Honors Orientation, and the Undergraduate Research Awards. The actions and experiences of the UMBC community yield clear lessons practitioners can use to influence change that can lead to increased student engagement and success. This interactive workshop will identify and dissect these best practices, innovations and the rationale behind critical components that impact institutional culture, climate, and support systems on underrepresented students' success, and their potential as catalysts for effective interventions.

W05: Harnessing the Power of Longitudinal Qualitative Data

Robin Remich, Remi Jones, and Christine Wood—all of Northwestern University

The central goals of most STEM interventions are to promote student interest and retention over time. Longitudinal qualitative analysis is one of the most powerful ways to describe and explain change over time. Qualitative data from open-ended survey questions, in-depth interviews, focus groups, and even participant observation can help us understand the processes and factors that influence behaviors and decision-making. Using longitudinal methods, we can capture the changes and consistencies in subjects' thinking and actions over time. By collecting and analyzing qualitative data longitudinally, program evaluations and research studies are able to capture the complex factors and conditions that lead to a particular outcome, such as a career decision.

One major benefit to longitudinal qualitative approaches is the ability to capture a subject's thinking and decision-making in vivo, giving us a chance to understand more deeply the contexts, feelings, and thoughts that factor into a subject's decisions or actions. Qualitative interviews and other open-ended methods conducted at successive time points are able to capture evolution and change. Although qualitative evaluation and research are typically conducted with small sample sets, some studies utilize larger samples, requiring different techniques of data reduction and display to reveal changes and trends over time. The size of a sample and the complexity of analyzing qualitative data over time can lead to hesitation and frustration when trying to gather and make sense of the data.

This workshop will introduce participants to the fundamentals of longitudinal qualitative data collection and analysis and will cover techniques of how to gather, display, and analyze findings. We will provide practical strategies for those interested in designing a study using longitudinal qualitative data, as well as for those who have gathered data and are wondering, "What do I do with the data now that I have it?" We will use our large research project on career decision-making, started in 2008 and ongoing with over 200 participants, to show concrete examples as we discuss methods and techniques of longitudinal qualitative analysis. The workshop will include

time for participants to describe their own data strategies and dilemmas, and bring up issues for discussion and shared learning.

The workshop will include:

1. An introduction to longitudinal qualitative methods as a way to capture the complex processes and mechanisms that underpin certain outcomes, including explanation and examples of the various ways of collecting and organizing qualitative data;
2. A focus on the strengths and limitations of conducting longitudinal analysis using qualitative methods;
3. A discussion of an ongoing longitudinal study on career decision-making in the biomedical sciences and a step-by-step explanation of how to code, display, and analyze a large sample of interview data using an approach we have developed;
4. A list of articles and resources on designing and executing longitudinal qualitative research.

Supported by R01 GM085385 and R01 GM107701.

W06: Success Strategies from Women in STEM: A Portable Mentor

Christine S. Grant—University of Guelph; and Peggy Pritchard—North Carolina State University

An important question that is often asked by aspiring professionals in Science, Technology, Engineering and Mathematics (STEM) fields is: "What are the important skills that I need to climb the ladder while successfully managing my career (both academic and professional)?" Mental toughness, personal style, networking, mentoring, transitions, time stress, leadership, balance, and negotiation are all core skills required to succeed in STEM fields. In this contribution, the co-editors of Success Strategies from Women in STEM: A Portable Mentor, Second Edition highlight the critical aspects of the above skills (which are also the chapter titles in the book) crucial for growth as a STEM student and a STEM professional. The second edition of their book, originally entitled, "Success Strategies for Women in Science" is a comprehensive and accessible manual containing career advice, mentoring support and professional development strategies from leading women in STEM fields. The presentation will draw from the numerous career management anecdotes and vignettes to illustrate the practical applications of the lessons contained in the book.

While the interventions recommended in the book focus on empowering women (and men) with knowledge needed to navigate the STEM waterway; this conference contribution will connect these personal strategies for success with research recommendations to broaden STEM participation. There are also implications for positive change (e.g., retention) that could result from the coupling of collegiate and early STEM career interventions (skills development focused on women and diverse groups) with broadening participation research.

There is, however a disconnect in the academy. Our programs for broadening participation and STEM diversity are often operating in silos and not well "integrated" in the fabric of an institution. As an administrator in a college of engineering, the presenter has seen firsthand the difficult choices that are made in fiscally challenging times. These challenging decisions that attempt to meet the best interests of the institution, can often appear to be "at odds" with the interventions that UI researchers recommend for positive change. An even more pressing question is, "How do we move the research findings and the established passion on these topics (and even results from federally funded programs on our campuses) into the threads that tie the academy together?" Understanding: (i) the priorities of the faculty and departmental leadership "in the trenches", (ii) the guiding principles and best practices to broaden participation in STEM and (iii) the perspectives of an underrepresented STEM professional (who is also a Woman of Color) will provide unique insights into positively impacting actual practices.

In this session, we will also explore the implementation of the core skills, with an emphasis on mentoring/coaching, to help the various stakeholders and beneficiaries in the academy

understand which interventions can be successfully applied to their own institutions. Specifically, how we can utilize strategically "placed" allies to connect with and coach university leaders and faculty to implement interventions routed in scholarly research.

W07: National Research Mentoring Network: "Steps toward Academic Research" Fellowship Program (NRMN STAR)

Harlan Jones—University of North Texas Health Science Center

This workshop is provides information about an ongoing professional development activity for faculty from minority serving institutions and an opportunity to discuss the program outcomes with participants.

Learning Objectives:

1. Program for career development for diverse faculty
2. Learn about best practices in delivering grantsmanship and grant writing skills
3. Learn about mentored research development in health disparities
4. Learn from previous STAR fellows about how being a STAR fellow helped their career development

Learning Outcomes

At the end of the workshop, participants will know about a unique fellowship program for junior investigators catered to train them in health disparities.

W08: Evaluation as a Tool to Strengthening Programs: A Primer for the Non Evaluator

Anthony L. DePass—Long Island University; and Elisabeth Russell-McKenzie—Temple University

For many, success of training programs that employ interventions that promote research related careers is often in the numbers of students that enter doctoral programs or attain the PhD. These metrics often serve as the primary measures for success or failure. This workshop will explore ways that a non-evaluator can think about and use appropriate evaluation strategies to measure broader institutional impact as well as cognitive and non-cognitive student development.

As STEM educators move towards more integrative and active modes of teaching and learning, how can they ensure that the experiences they are designing are leading to the intended student learning outcomes? How are evaluation and assessment methods being designed in ways that connect quantitative and qualitative data to help refine learning environments so that all students benefit from high-quality, high-impact practices? We will examine the links between program design and program evaluation, to illustrate how assessments might be designed, data collected, and findings used to both advance student success and contribute to faculty scholarship, promotion, and tenure.

W09: NSF INCLUDES: Empowering All Youth for STEM

Claudia Rankins, Jessie DeAro, Jermelina Tupas, and Sylvia James—all of the National Science Foundation

The National Science Foundation's (NSF) 2016 budget request includes a new bold initiative related to broadening participation in science, technology, engineering, and mathematics (STEM) called NSF INCLUDES (Inclusion across the Nation of Communities of Learners that have been Underrepresented for Diversity in Engineering and Science). This workshop will be a part of a broad effort to engage various communities and stakeholders to help inform the NSF INCLUDES investment. Discussions will be facilitated in small groups and large groups toward the identification of a set of "bold visions" for broadening participation in STEM. INCLUDES is

envisioned as a comprehensive national initiative that uses a collective impact approach to increase the preparation, participation, advancement, and contributions of all scientists and engineering students, including those who have been traditionally underserved and/or underrepresented in STEM. This includes underrepresented ethnic/racial groups, women and girls, and persons with disabilities.

The INCLUDES initiative is currently planned to have two pilots in fiscal year (FY) 2016: 1) Networks for STEM Excellence; and 2) Empowering All Youth for STEM. This workshop will focus on the Empowering All Youth for STEM pilot that will be led by the Directorate for Education and Human Resources in collaboration with the other NSF Directorates and the Office of Integrative Affairs. Through this initiative NSF anticipates supporting proposals to design, implement, and assess models that provide engaging STEM learning opportunities for youth in the middle grades that build on students' innate curiosity and experiences. The initiative will build on the literature on important variables such as grit, collaborative problem solving, growth mindset, and motivation. INCLUDES projects are expected to propose ways of empowering youth and building their capacity to seek out existing or to develop new local, regional, national, and international resources for STEM.

NSF is interested in consulting the STEM research and education community and stakeholders in order to develop the "bold visions" for broadening participation that will be used to guide INCLUDES efforts. Bold visions can focus on addressing challenges and barriers to the full participation of diverse learners in STEM experiences or articulated as STEM education goals for youth. NSF anticipates that community organizations, informal learning enterprises, developers of technology, and cyberlearning experts will participate in INCLUDES and that creative partnerships with business and industry could be leveraged with this initiative

Poster Abstracts

Barriers and Solutions to Advancing Careers

A01: Assessing Interventions Aimed at Promoting Women's Advancement in Computing Careers

Heather Wright, Ama Nyame-Mensah, and Jane Stout—all of the Computing Research Association

Women are underrepresented at all levels of the computing research pipeline. Underrepresentation can lead to feelings of isolation, lack of fit, and attrition from a field. To help alleviate these issues, the Committee on the Status of Women in Computing Research (CRA-W) runs mentorship and career development programs for women early in their computing careers. Two such programs are Grad Cohort and Career Mentoring Workshops, which are both workshops geared towards providing mentorship and connecting women with a supportive community. These programs also unite junior researchers and graduate students with women already established in their field. The established professionals provide practical information, advice, and support to their younger colleagues.

The Center for Evaluating the Research Pipeline (CERP) provides assessment for CRA-W programs through a multi-method research design. For one, CERP uses a pretest/posttest research design to assess the immediate impact of intervention programs on participants. For instance, this type of assessment indicates that Grad Cohort has a positive immediate influence on women computing graduate students' self-efficacy, interpretation of setbacks, strength of professional network, networking skills, and knowledge about skills necessary for professional growth.

CERP also conducts longitudinal, comparative evaluation that assesses the impact of an intervention on program participants versus non-participants over time. This technique has yielded a comparison database that has become a powerful national resource for the computing community. This type of data analysis also allows for the assessment of whether the CRA-W's programs promote success and persistence among women in computing compared to women who have not participated in CRA-W programs and compared to men. By collecting baseline data from both participants and non-participants, and assessing change in successes and persistence patterns across time, the CERP model offers a rigorous means of quasi-experimental research on interventions aimed at broadening participation in science careers. We will share our analytic model, methodology and preliminary results with conference attendees.

A02: The Prelim-Prep Group: A Multi-part Intervention for Improving Graduate Student Performance during the Preliminary Qualifying Exam

Raquel Y. Salinas and Sherilynn J. Black—both of Duke University

The Preliminary Qualifying Exam (PQE) is a critical academic milestone in the career of each graduate student pursuing a PhD. While each institution may vary slightly in their approach to the exam, the overall goal of the exercise is to 1) evaluate the scientific merit of the thesis proposal, 2) assess the scientific knowledge of the examined individual, and 3) to develop scientific writing skills (written scientific proposal) and scientific communication skills (verbal scientific presentation). In most biomedical science departments and programs across the nation, this exam lasts 2-3 hours and is a comprehensive evaluation of both oral and written exercises. Due to the high stakes nature of the PQE, it serves as a high stressor for many graduate students and can often mark the point of attrition from graduate school. For underrepresented students who may suffer from imposter syndrome and/or a lack of self-efficacy, this exam can lead to an even higher level of stress and anxiety beyond what a non-underrepresented student would face. To address these issues, we implemented a longitudinal, multi-part intervention designed to assist students in mastering the

specific skills necessary for success in the PQE. The intervention, entitled "The Prelim Prep Group", consists of a series of seminars and skills-based exercises designed to equip students with the knowledge and abilities required to succeed in the PQE. Students from a variety of scientific disciplines work together in a cohort to improve their skills in scientific writing, scientific communication and exam strategies. Importantly, student participants provide a high level of emotional and academic support for one another during the lengthy preparation process. Results indicate that students participating in this intervention feel more confident and prepared for the exam, and student participants have experienced high PQE success rates.

A03: Impacts of a Career Coaching Intervention on Biomedical PhD Students' Career Planning, Professional Development and Understandings of "Diversity, Difference and Discrimination"

Simon Williams, Bhoomi K. Thakore, Veronica Womack, Letitia Onyango and Rick McGee—all of Northwestern University

In this poster we examine the impacts of an Academic Career Coaching intervention called the "Academy for Future Science Faculty" (hereafter the Academy). The Academy is an NIH-funded intervention for the professional development of PhD students in the Biomedical Sciences. It involved annual in-person meetings in its first 2-3 years, sustained by virtual meetings and individual contacts with a 'coach' and a coaching group of 10 students. This report focuses on quantitative and qualitative data to explore differences by race-ethnicity (URM status) and gender, focusing on two main areas: 1) The impact of the Academy on students' Career Planning and Professional Development; 2) The impact of the Academy on students' understandings of the role of Diversity, Difference and Discrimination in academic careers and professional "success".

In this poster, we focus on the second Academy group, which consists of a diverse cohort of 60 PhD students near the completion of their PhD. Six "Academic Career Coaches" (faculty with high levels of expertise guiding research training) provided expert advice and guidance to the students and led the activities of their Coaching Group of 10 students. Surveys were administered to students at the end of each of the three days of the first in-person meeting in 2011. The non-parametric Mann-Whitney U test was used to explore potential differences by URM status or by gender. Overall, the majority of participants felt the Academy had a positive impact on their Career Planning and Professional Development. Of the 14 Career Planning and Professional Development items, 10 were non-significant by URM status, and 11 were non-significant by gender. URM students were significantly more likely to report benefits from discussions on seeking and designing a postdoc, how to achieve their ultimate career goal, and how to take control of their mentoring. URM students were also significantly more likely to see value in the use of their Individual Development Plan (IDP). Female students were significantly more likely to report benefit from discussions on seeking and designing a postdoc, being more confident in their ability to write an NIH grant proposal, and seeing an academic career to be more achievable. Qualitative data revealed that students felt they learned how to be proactive in their postdoc planning, how to be assertive in communicating with their mentor, and that there is a "science to writing grants". Students also felt the IDP helped them to "set goals" and that an academic career seemed more "doable".

Overall, the majority of students felt that their understanding of how Diversity, Difference and Discrimination operated in science increased. All 6 items in this category were non-significant both by URM status and by gender, suggesting that both well-represented and under-represented students can learn from, and participate in, discussions about diversity. Qualitative data revealed that both well-represented and under-represented students reported feeling a "greater awareness of discrimination", "a need to confront the reality of discrimination" and knowledge of "the politics" that characterize science careers and professional promotion.

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A04: Gender, Ethnicity and Successful STEM Intervention Outcomes: Integrating Self-Authorship and Self-Efficacy Perspectives

Michelle Randolph and Phillip J. Bowman—both of University of Michigan

Gender and ethnic comparisons reveal that talented African American females with interests in STEM fields must overcome great odds to achieve their educational and career goals. Existing strengths-based research has begun to provide new insights into factors critical to their success in STEM fields – what motivates them, how their backgrounds and family relationships have shaped them, and challenges faced by the growing number of high achievers who beat the odds. This comparative study integrates insights from both self-authorship and self-efficacy models to better understand successful STEM outcomes among of African American females in pipeline interventions. Building on the strengths-based literature, this study explores the specialized talents and motivations associated with successful STEM outcomes among African American females in an undergraduate pipeline program that promotes Ph.D. studies and faculty careers among underrepresented students.

More specifically, this study seeks to explore the following questions: (1) how African American females differ from others in pipeline intervention settings on specialized talents? (2) the relationship between specialized talents among African American females with STEM major, STEM Ph.D. and STEM research career plans? and (3) do research self-efficacy moderate the relationship between specialized talents and successful STEM outcomes among underrepresented females in pipeline interventions? The survey data for this poster comes from a NIH-NIGMS supported study of students engaged with the CIC-Summer Research Opportunity Program (CIC-SROP), which is an undergraduate pipeline program at 12 major research universities. Comparative and inferential statistical analyses systematically explore the specialized talents and motivations associated with successful STEM outcomes among African American females. Research findings will be discussed with a particular emphasis on theoretical issues as well as practical and policy implications for STEM interventions.

A05: Strengths Based Leadership Training for Graduate Students and Postdocs Leading Campus Organizations Dedicated to Diversity

Steven P. Lee and Carlos Ruvalcaba—both of University of California, Davis

As many initiatives strive to build a diverse and inclusive community at academic institutions, a critical component are campus organizations that are led by students and postdoctoral scholars. These organizations provide an opportunity for students and postdocs to take ownership and contribute to building a diverse community themselves, and to also gain and practice leadership skills that will be invaluable for their future success. However, their service for these organizations is not often supported with leadership training and related resources. This gap in support makes it challenging for these organizations to grow and thrive, and hinder their contributions to building a diverse community for students and postdocs from underrepresented minority (URM) groups.

To fill this gap, a novel intervention was implemented at UC Davis in Winter 2015 for graduate student and postdoc leaders of campus organizations that are dedicated to creating a diverse and inclusive community. This intervention provided leadership training for 18 leaders (16 of whom are in the STEM disciplines) of seven different organizations:

1. API Grads – Asian and Pacific Islander Grads
2. BGPSA – Black Graduate and Professional Student Association
3. Chemistry URM Committee
4. Ecology Diversity Committee
5. ESTEME – Equity in Science, Technology, Engineering, Math, and Entrepreneurship
6. LGSA – Latina/o Grad Student Association
7. PSA – Postdoc Scholars Association

These graduate students and postdocs participated in leadership training that involved professional development workshops to assess and apply their leadership strengths for their respective organizations. The training materials focused on the Gallup StrengthsFinder 2.0 assessment test and "Strengths Based Leadership" book, along with materials from the Myers-Briggs Type Indicators (MBTI). This leadership training had two primary goals: (1) to help each grad student or postdoc to succeed in their own academic programs or appointments by assessing and applying their strengths; and (2) to help each organization to grow and thrive, and thereby to help create a diverse and inclusive community.

The leadership training consisted of assessment tests and five workshops that focused on community building and professional soft skills. After an introductory workshop, each of the following four workshops consisted of three components: (a) lessons on one of the four Gallup strength domains and MBTI dichotomy; (b) team exercises that involved applying those lessons for each leadership team and organization; (c) reporting back to the whole group on how they are applying the lesson, to encourage sharing of ideas and collaborations. This leadership training is a new activity for the Graduate Diversity Network (GDN), which was recently created at UC Davis to help facilitate communication and collaboration for the many people and programs that are dedicated to strengthening graduate education through diversity.

This presentation will provide a summary of the materials, exercises, and results from the leadership training, along with the evaluation received from the participants. Overall, the feedback has been overwhelmingly positive, as the participants appreciated gaining skills in community building and professional soft skills to succeed personally, and to benefit their respective organizations. We will also present future plans for this leadership training, along with other activities of the GDN at UC Davis.

A06: Determining Learning Environment Components in Research Diversity Intervention that Promotes Success to the Next Career Level

Debra Murray and Dawayne Wittington—both of Baylor College of Medicine

During the development and early implementation of the Human Genome Project, minority scientists were noticeably absent. To address this shortage, grantees of the National Human Genome Research Institute were encourage to provide training to increase representation of minorities in this field. The Baylor College of Medicine's Human Genome Sequencing Center (HGSC) established an HGSC-Minority Diversity Initiative to give under-represented minorities an opportunity to obtain hands-on research in the genomic sciences to encourage participants to pursue doctorates in these fields. Our most successful intervention is the year-long post-baccalaureate program called the HGSC-PreGraduate Education Training (PGET). Our study focused on whether we established a learning environment that fostered the promotion of participants to the next career level. Specifically we wanted to determine the most critical element that led to success as indicated by advancement of the participants. We used Cross-Sectional Surveys, focus groups, and individual interviews to gather data from our program participants and their mentors. Our data indicate that while several components were involved in the success of the participants, the critical element to the participants' success was the mentoring component. Our future studies will investigate how these various mentoring components impact the participant's success and how we can utilize these resources to create a more positive learning environment.

A07: Can Mentoring Style Influence the Career Path Choice of Trainees?

Hwa Young Lee, C. B. Anderson, S. Chang, C. D. Baldwin, C. Cameron—all of The University of Texas MD Anderson Cancer Center

Introduction: While everyone recognizes that mentoring is important for trainee career success, most studies focus only on presence of a mentor, the mentoring function (career, psychosocial, etc.), and quality of mentorship defined broadly. Only one study mentions that mentors' prosocial traits (or style) significantly influence their specific mentoring behavior. In the biomedical science research literature, however, no single study addresses the mentor's style. A useful area of related research focuses on parenting style. Empirical studies suggest that parenting style is a significant predictor of children's attitudinal change and outcomes; we sought to study whether Baumrind's framework of parenting style could be used to assess mentoring style and trainee outcomes. Our purpose was to investigate the relationship between mentoring style, defined in terms of the constructs of the mentor's demandingness and responsiveness, and the trainee's intention to pursue a career path choice.

Methods: An online survey was administered to biomedical and behavioral graduate students and postdoctoral fellows (N= 510) at various institutions in Texas. Trainees were asked to report on their current mentor's style, using definitions borrowed from Baumrind framework of parenting style. We defined demandingness as the mentor's rule orientation, monitoring, insistence, and high expectations, and responsiveness as encouragement, adjustment, allowance, care, persistence, and openness. Our trainee outcome variable of research career path intention was measured by level of trainees' agreement on each of three questions, including academic research career as a principal investigator (PI), research career outside academia, and academic research career not as a PI. Hierarchical regression analyses were conducted to determine whether each mentoring style (demandingness and responsiveness) predicts trainees' career intentions, after controlling for trainee and mentor demographic characteristics.

Results: Mentor responsiveness was an important predictor of a trainee's intention to pursue a research career in academia as a PI ($p<.001$; adj. $R2=15.4$). Trainees who reported that their mentors were more responsive were significantly more likely to express interest in a research career as a PI. Both responsiveness and demandingness were significant (or marginally significant) predictors of a trainee's intention to pursue a research career outside academia (ps= <.001 and .065, respectively; adj. $R2=6.8$). Trainees who reported that their mentors were more responsive and less demanding were more likely to express their interest in a research career outside academia. On the other hand, mentoring style was not a significant predictor of a trainee intention to pursue a career as an academic research scientist but not as a PI; for a trainee intention to pursue that career path, the only variable that was a significant predictor was a trainee's primary language (adj. $R2=1.9$).

A08: Understanding the Relationship between Mentor Beliefs and Perceptions and Mentoring Trainees in Scientific Communication Skill (SCS) Development

S. Chang, H.Y. Lee, C. B. Anderson, and C. D. Baldwin—all of The University of Texas MD Anderson Cancer Center

Purpose/Methods: Encouraging reports show that mentoring can improve with training. However, little is known about how the beliefs of mentors predict their efforts to strengthen trainee SCS. Our purpose was to understand motivations for mentoring in SCS, we hypothesized that mentors who feel more strongly that mentors have a responsibility for training in SCS are likely to 1) help strengthen their trainees' SCS more often, 2) perceive fewer barriers to SCS mentoring, 3) believe that the benefits of mentoring outweigh the costs, and 4) believe that many trainees in their field lack sufficient skill in SC. We surveyed faculty mentors of biomedical doctoral and postdoctoral

trainees, and used latent class analysis to group 159 individuals, based on seven indicators: perception of widespread weakness in SCS of trainees in one's field (1 item); belief in the responsibility of the mentor to provide training in SCS (1 item); beliefs in costs and benefits of mentoring (14 items for 2 indicators); and perceptions of barriers to mentoring in SCS, including barriers of trainees (15 items), self (14 items), and environment (6 items). We compared the demographic composition of classes, and mentoring practices categorized as writing (8 items), speaking (5 items), presenting (4 items) and general (17 items). Item responses used a 5-point Likert scale (1=strongly agree, 5=strongly disagree).

Results: We identified three classes of mentors, all of whom strongly felt that the responsibility of teaching SCS belonged to mentors and that the benefits to mentoring were many. Highly Motivated Mentors (HMMs, 8%) tended to perceive fewer barriers to mentoring in SCS, lower costs of mentoring, and a higher prevalence of weak skills among trainees in their field. Fairly Motivated Mentors (FMMs, 53%), compared to the HMMs, reported higher SCS mentoring barriers and similar costs of mentoring, but perceived a lower prevalence of weak skills among trainees in their field. Motivated Mentors (MMs, 39%), compared to others, perceived the highest barriers to SCS mentoring, and reported that the costs of mentoring were higher and almost equaled benefits. Like the FMM group, the MMs also reported perceiving a lower prevalence of weak skills among trainees in the field. Mentor class membership did not differ by academic rank, primary language, discipline, type of advanced degree, experience mentoring minority trainees, or formal training in SCS mentoring. Women were 1/3 of the HMM and FMM groups and 1/2 of the MM group.

Compared by mentoring practices, HMMs performed general behaviors more often than FMMs ($p=0.075$) and MMs ($p=0.003$), including helping trainees increase productivity and plan careers. HMMs also provided more support in writing than MMs ($p=0.075$), including providing access to editors, and giving constructive critiques. However, HMMs reported spending less time than FMMs and MMs helping trainees prepare first-authored, first submission research manuscripts; MMs spent the most time ($p=0.008$). HMMs reported more often having trainees who needed intensive SCS help than FMMs ($p=0.03$) or MMs ($p<0.001$). In our preliminary work, beliefs about mentoring distinguish three types of mentors who engage in SCS mentoring at different levels, suggesting that beliefs may influence mentor behaviors in predictable ways. Knowing more about how perceptions of mentors influence their behaviors may help increase the efficacy of mentoring interventions.

A09: The Tuskegee Alliance to Forge Pathways to Academic Careers in STEM (T-PAC)

Shaik Jeelani and Mohammed A. Qazi—both of Tuskegee University; Melody Russell, Jared Russell, Martha Escobar, Michelle Vaughn and Robert Alex Sauer—all of Auburn University; and B. K. Robertson—Alabama State University

The Tuskegee Alliance to Forge Pathways to Academic Careers in STEM (T-PAC) is a collaborative effort among three doctoral granting institutions in the state of Alabama consisting of two Historically Black Universities, Tuskegee University (TU) – the lead, Alabama State University (ASU); and a Traditionally White Institution, Auburn University (AU). T-PAC recruits 18 first year URM doctoral students (T-PAC Scholars) at the three Alliance institutions and assists them in their preparation through a promising novel model for STEM doctoral education (URMs or underrepresented minorities include African Americans, Hispanic Americans/Latino, American Indians, Alaska Natives, Native Hawaiians and other Pacific Islanders – racial and ethnic minorities that are underrepresented in STEM). The novelty of the T-PAC model lies in the joint mentorship that is provided by engaging Scholars in interventions that are characterized by their virtual nature. These strategic interventions have the potential to eliminate barriers and promote positive practices for URMs to successfully progress and transition through the various critical phases of their doctoral programs of study, such as completion of graduate course work, preparation for

qualifying examinations, carrying-out research, and writing a publishable thesis. Readiness for STEM Professorial careers is advocated and emphasized throughout the T-PAC model.

Our poster will describe the efforts of the T-PAC Alliance to develop, implement, study and evaluate the proposed model for STEM doctoral education. A strong emphasis in our description will be placed on the study of the model and understanding its interventions using qualitative and quantitative techniques from educational research and the social sciences. This longitudinal study is guided by a research agenda that addresses several strategically formulated research questions. Results to-date will be summarized.

The T-PAC Alliance is funded by a grant of the National Science Foundation's (NSF) Alliances for Graduate Education and the Professoriate Program – Transformation (AGEP-T), effective September 1, 2014. Only eight (8) AGEP-T Alliances are currently operating. T-PAC is the only one led by an HBCU. These facts attest to the strong outcomes potential of the T-PAC Alliance in doctoral degree production among URMs and their transition to research careers.

Evaluation and Program Efficacy: Lessons from the Literature

B01: A Developmental Rubric for Assessing Short Term Student Progress in an International Summer Research Program

Fernando Nieto and Duncan A. Quarless—both of SUNY Old Westbury

A new student performance assessment plan was implemented for students participating in the Old Westbury Neuroscience International Program (OWNIP), based on a developmental rubric. The assessment is linked to an online hybrid mentoring model that complements the on site research mentoring by OWNIP foreign collaborators. The rubric includes three basic criteria, content knowledge, quantitative reasoning and multiple representations and five achievement levels. Each achievement level reflects the development of a student from its freshman year (level 1 to 1.5) to the senior level (level 3), master's level (level 4) and PhD (level 5). By in large students entering the OWNIP are rising seniors and graduating seniors. It is assumed they are able to perform at levels 2.5 to 3. The goal of the program is to document movement to level 3 to 3.5. These three criteria were applied to the scoring of three assessment instruments: an annotated bibliography, including ten research articles related to the topic of their research, a research report, including three drafts and a final, and an oral presentation. Students could access the scoring rubric prior to the online submission of the assignment. Based on the first draft of the research report students entered the program on average at a level 2.0 ± 0.22. At the end of the summer students achieved on average a 3.42 ± 0.25 level in the final research report. Their performance on the annotated bibliography was significantly lower than expected at the entry level, 1.75 ± 0.18 while achieving a level 2.75 ± 0.45 by the end of the summer. This data supports the use of a hybrid online model together with a well-prescribed developmental rubric for the assessment of student progress in a short-term international research experience. It also validates this approach for the purpose of program assessment of short-term objectives.

This program is funded through a Minority Health Disparities International Research Training (MHIRT) grant#T37MD001429.

B02: The Beyond Traditional Borders Program at Rice University: Assessment of a Global Health Education Program

Sandra Bishnoi, Veronica Leautaud, Maria Oden, and Rebecca Richards-Kortum—all of Rice University

The primary objective of the 2006 HHMI grant to Rice University was to develop, implement and expand Beyond Traditional Borders (BTB), a multidisciplinary education program in global health

technologies at Rice University. BTB trains students from all majors to reach across geographic and disciplinary boundaries to design and implement solutions to global health challenges with the goal of creating a new globally minded generation of leaders in science education, and engineering. BTB also aims to take advantage of problem based learning (PBL) to engage students in Science, Technology, Engineering and Math (STEM) disciplines and majors, while ensuring the creation of global citizens, aware of global health issues, empowered to apply technology solutions, capable of communicating effectively and conducting advocacy for these global health issues. These open ended- client based projects provide students with real life opportunities to engage in research, which has been demonstrated to improve persistence in STEM, especially in women. BTB is a diverse program, attracting a significant fraction of women and underrepresented minority students (URM). Between 2006 and 2013, 689 students have participated in BTB courses and program activities, with 13% of these corresponding to URMs. Compared to the general student population, BTB attracted a significantly higher proportion of women; up to 64% of students participating in program activities between 2006 and 2013 were female students, in contrast to the 48% enrolled at Rice in the year 2008. As part of our year 3 report for the HHMI EXROP 2010 grant, we conducted an online survey among Rice students participated in BTB design-based courses since 2006. The survey was sent out to 435 students, and 180 responses were collected from July 2013 to September 2013. We assessed the composition of the program, as well as the gains reported by students using the Classroom Undergraduate Research Experience (CURE) inventory. We also assessed the effect of BTB on student perceptions and attitudes towards global health, and career outcomes, specially the intention of pursuing Global Health Careers. The results of our survey have shown that the creation of a program that places open ended design projects within a well-defined societal context, in our case Global Health, can provide significant and unique growth opportunities for students that go beyond what is traditionally taught in a classroom, specifically leadership, teamwork, and creative problem solving skills. The students valued the feedback between classroom theory and mentorship to field testing a product to meet the demands of a resource challenged area and then seeing the product implemented. Moving from an "open-ended" problem to an actual deliverable provided significant motivation to the students, despite the fact that they had to put a considerable amount of time into the projects compared to a traditional course. The skills developed in the BTB program were clearly transferrable into any career chosen by the students; however, the experience of working in Global Health was rewarding enough to inspire a large percentage of participants on focusing their future careers on Global Health. Our results are consistent with the issues addressed in social cognitive career theory that the combination of self-efficacy, outcome expectations, interests, and social supports help determine a student's major career choices.

Intersection of Non Profit Organizations and Interventions

C01: The Society of STEM Women of Color, Inc.: An Intersectionality Theory Approach to Broadening Participation

Kelly Mack, Claudia Rankins, Patrice McDermott, Orlando Taylor, and Falcon Rankins— all of Society of STEM Women of Color, Inc.

If the U.S. is to remain a competitive leader in science and engineering, radically different approaches to maximizing the potential of its domestic talent pool are imperative. However, women of color (Black, Hispanic, American Indian) – who now represent one of the fastest growing undergraduate populations in US higher education as well as a significant part of what is expected to become the largest percentage of our populace by the year 2042 – remain a largely untapped resource. Further, the underrepresentation of undergraduate minority women in STEM is not

expected to change significantly without a critical mass of same-race/same-gender faculty role models who are believed to provide one of the greatest influences and determinants of success in STEM disciplines.

However, STEM women faculty of color are too few in number to comprise a critical mass, and, more importantly, institutional professional development efforts aimed at retaining diverse faculty continue to overlook the role of intersectionality in STEM career advancement, fail to inextricably link intersectional approaches with strategic planning for diversity, and are devoid of the elements of self-efficacy needed to sustain long-term change and coping ability.

To that end, the Society of STEM Women of Color (SSWOC), Inc., a non-profit 501(c)(3) organization, founded in 2014, relies upon a comprehensive approach to professional development that empowers STEM women of color for career actualization, contributes to the research base and national discourse on the role of intersectionality in the academy, and harnesses a centralized body of knowledge and best practices that will support institutions of higher education in expanding their capacities to recruit, retain and advance a diverse STEM faculty.

A major activity of SSWOC, which represents the largest network of women of color from all academic STEM disciplines, is its annual STEM Women of Color Conclave. The Conclave brings together nearly 200 women and men faculty and administrators of diverse backgrounds, professorial ranks, and institution types – with increasing attention to Latinas and American Indian women in STEM. The intensive 2-day professional development meetings are grounded in intersectionality and self-efficacy theories that support and accelerate transition through the various stages of career identity, while also catalyzing self-efficacy for achieving career and leadership actualization.

This presentation will highlight preliminary data, which suggest that Conclave participation, as well as other intersectionality theory driven models of STEM faculty development, may have an impact on scholarly productivity.

C02: Using National Survey Data to Assess Interventions

Ama Nyame-Mensah, Heather Wright, and Jane Stout—all of Computing Research Association

Comparative evaluation is used in social science research to explore how an intervention affects participants compared to non-participants. In recent years, this analytic technique has become a preferred method for evaluating computing, science, engineering, technology, and mathematics (C-STEM) intervention programs because it allows for a quasi-experimental design. The Computing Research Association's Center for Evaluating the Research Pipeline (CERP) utilizes comparative evaluation in order to assess the effectiveness of intervention programs aimed at increasing diversity and persistence in computing-related fields. To do so, CERP disseminates surveys to a national sample of computer science students enrolled at institutions across the United States. CERP's surveys measure (a) students' participation in intervention programs; (b) correlates of success and persistence in computing (e.g., sense of belonging; self-efficacy); (c) academic and career intentions (e.g., intentions/aspirations to pursue a PhD in computing); and (d) actual persistence in computing.

Importantly, CERP's data are culled from very large samples of computing students each year, and these datasets contain diverse demographic information, including socioeconomic variables, that serve as covariates during program assessment. Further, CERP's data contain indices of participants' and non-participants' achievement and motivation such as reported GPA and involvement in external research activities. In order to conduct rigorous comparative evaluation, CERP analysts statistically control for background variables that could explain students' tendency to participate in intervention programs and obtain academic success. In this way, CERP's assessment measures the impact of intervention programs on participants' versus non-participants' outcomes over and above other predictors of student success and persistence in computing.

One research question that CERP addresses using comparative evaluation techniques concerns the beneficial nature of research experiences for undergraduates (REU) on computing students' preparation and aspirations for graduate school. Specifically, CERP is currently evaluating whether computing REUs are similarly effective for underrepresented (all racial/ethnic minorities and women) and well-represented (White and Asian Males) students pursuing computing degrees. This poster will highlight CERP's comparative evaluation model using its research evaluating REU programs.

How Practice Informs Research

D01: Effective Low Cost Recruitment Strategies That Attract Underrepresented Minorities to Summer Research Programs

Cherilynn R. Shadding, Dawayne Whittington, Latricia E. Wallace, Sylvia Wandu, and Richard K. Wilson—all of The Genome Institute at Washington University in St. Louis

The paucity of underrepresented minorities (URM) earning STEM degrees remains an issue in revitalizing the U.S. biomedical workforce. Due to reductions in federal funding, maintaining the integrity of programs that focus on URM retention and recruitment is crucial. We present data on cost-effective mechanisms used to recruit students to an undergraduate summer research program, Opportunities in Genomics Research. Our data show that these mechanisms (e.g. email, events, referrals, website) were equally effective in attracting applicants to the program. However there were gender, race and institutional differences in who were attracted to the program. We further classified recruitment mechanisms relative to their cost to implement. Our results indicate that lower cost mechanisms were equally successful in recruiting students to our summer program who persisted to Ph.D. programs as well as other STEM professional degree programs (M.D., D.D.S). Results from a binary logistic regression showed that the relative cost of recruitment mechanisms was one of five variables distinguishing Ph.D. and non-Ph.D. pursuants in our sample. Additional data is needed to determine the level of contribution of the relative cost variable. Collectively, these data demonstrate for the first time that lower cost mechanisms are successful in recruiting URM to summer programs that eventually pursue Ph.D.'s in STEM fields.

D02: Together We Stand, Divided We Fall: The Meyerhoff Scholars Program Community

TaShara C. Bailey, Mario Sto. Domingo, and Kenneth I. Maton—all of University of Maryland, Baltimore County

There are growing numbers of pre-K to career pipeline interventions that are designed to improve college readiness among underrepresented students and better prepare them for advanced degrees and STEM careers (Carreathers, Beekmann, Coatie, & Nelson, 1996; Landis, 1985; Maton, Hrabowski, & Schmitt, 2000; Shay, 2000; Thomas, 1985, 1992). Although there are many promising models, it is becoming increasingly clear that we must move beyond single-component strategies (only financial aid, academic skills development, higher education promotion, career development, expert mentoring, or personal development) toward more comprehensive and multi-component interventions (Bowman & St. John, 2011; Trent & St. John, 2008; Hrabowski, Maton, & Greif, 1998; Hrabowski, Maton, Greene, & Greif, 2002).

Several descriptive and evaluation studies suggest that strong pipeline interventions contain multiple components and are formally structured or organized to be comprehensive. Specifically, there are three main categories of strong interventions: philanthropic (e.g., Meyerhoff Scholars Program, Gates Millennium Scholars Program), federal/governmental (e.g., National Science Foundation – Louis Stokes Alliances for Minority Participation), and consortia (e.g.,

Committee on Institutional Cooperation – Summer Research Opportunity Program).

The Meyerhoff Scholarship Program (MYSP), a formally structured comprehensive and multi-component social organizational system, at the University of Maryland, Baltimore County (UMBC) is recognized as a model for promoting underrepresented students' success in pursuing a PhD in science, technology, engineering, and mathematics (STEM) fields of study. The MYSP is organized around thirteen core components: financial aid, summer bridge, program values, advising/counseling, on-campus & summer research internships, faculty involvement, recruitment, study groups, program community, promotion of tutoring, administrative involvement/support, mentors, and family involvement/open communication with families. The proposed study builds on a strength-based approach with strong values and beliefs of positive organizational practices of program community to investigate participants' perspectives on how the Meyerhoff Scholars Program creates community during summer bridge (Kloos, Hill, Thomas, Wandersman, Elias, & Dalton, 2012; Oguntebi, Shcherbakova, & Wooten, 2012, Seligman & Csikszentmihalyi, 2000).

This theory-driven case study will employ responses to survey questionnaires from MYSP summer bridge participants in 2013 and 2014 and will utilize interview data from key personnel. Guided by the program theory of the MYSP model, the specific aim is to provide theory-driven insight into how the MYSP creates community during summer bridge. Findings from this study can further inform the refinement of best practices within the MYSP and the development of new strategies in fostering program community to promote students' success in STEM to further diversify the professional and research workforce.

D03: The Impact of Mentor Training on Researchers' Conception of Diversity

Kim Spencer, Stephanie House, and Christine Pfund—all of University of Wisconsin-Madison

In 2010-11, we conducted randomized controlled trial (RCT) across 16 academic health centers to test the effectiveness of a research mentor training curriculum adapted for clinical and translational researchers. As part of the assessment, structured post intervention interviews were conducted with 283 mentor/mentee pairs. Specifically, mentors were asked if they changed their behavior in each of the six mentoring competencies addressed in the training: 1) maintaining effective communication, aligning expectations, assessing understanding, addressing diversity, fostering independence, and promoting professional development. We used content analysis to assess overall behavioral changes, and found that 97% of mentors changed their mentoring behavior as a result of participating in mentor training.

We have since undertaken further investigation of the self-reported behavioral changes. Specifically we have analyzed the post-training data to determine the impact of training on these clinical and translational research mentors' conception of diversity and their behavior. Content analysis was used to code the interview responses of trained mentors into the following categories: no change, awareness, intent to change, or implemented change. Sixty one percent (N=84) of mentors reported some level of change, with 20% (N=17) describing specific ways of implementing changes to their behavior around concepts of diversity. We will present our findings, including analyses that examine the nature of these changes and what common elements present across the 16 academic health centers.

D04: Bridging the Divide, Program to Broaden Participation in STEM Ph.d.: Success and Challenges

Malathi Srivatsan, Nastassia Jones, Anissa E. Buckner, and Kandi Granberry—all of Arkansas State University

To sustain our global leadership in discovery and innovation for knowledge based economic growth, bold initiatives to significantly increase capacity in STEM fields are crucial. A challenge for Arkansas is that it is relatively less populated (ranks 33) yet its minority population is increasing

thus identifying the section of Arkansas population that needs to be encouraged and supported for increasing the talent pool in STEM. Underrepresentation of minorities, women, first generation students from rural areas, persons with disabilities and veterans (underrepresented groups, URG) in STEM fields is a major challenge facing Arkansas workforce. Research shows that a new recruitment strategy (holistic review of applications for admission) along with sustained support, training and wrap- around mentoring are essential for the academic success of URG students. Therefore, following the proven successful Fisk-Vanderbilt (FV) bridge program and modifying it to suit the needs of Arkansas, a nurturing and wrap-around mentoring program to expose undergraduates to research that will inspire them to join masters programs which will serve as a bridge to the doctoral programs is being implemented with funding support from NSF and resources from the three participating institutions, Arkansas State University-Jonesboro (A-State) and the two HBCUs in Arkansas, the University of Arkansas at Pine Bluff (UAPB) and Philander Smith College (PSC) in Little Rock.

In the first year of this program, we recruited seven undergraduate URG students to perform nine weeks of research along with professional development training at A-State during summer. The program also recruited one student to the master's program in environmental sciences at A-State with two additional applications, one for master's and one for Ph.D. program currently being reviewed for admission. The interactions among faculty in the three institutions have resulted in research collaborations that will help students in the three campuses to work together in research projects. Evaluation of our performance in the first year has provided valuable inputs. All the students who participated in the summer research unanimously evaluated their research experience as very valuable and expressed their decision to pursue graduate education. They also expressed a desire to have more opportunities for social interactions. While the program does face challenges such as distance between the three institutions, different levels of research infrastructure available in each institution and the faculty in all the three institutions having a heavy teaching load, the positive experiences of the undergraduate students and the small, yet positive increase in the admission of URG students in A-State in the first year of implementing this program have been very encouraging.

These results indicate that by adopting and modifying the FV bridge program, even in small universities and colleges (where most of the URG students opt to study) with limited resources it will be possible to significantly increase URG Ph.D.s in STEM through collaborative efforts, dedication, passion, learning, evaluating, responding and adapting. Knowledge gained from this project can help several other smaller and rural institutions to successfully implement measures to bridge the divide nationally towards developing innovators and scientists of the future from diverse backgrounds.

Training STEM Undergraduates: Lessons for Minority Serving Institutions

E01: Increasing Recruitment and Persistence of Underrepresented Minorities in STEM Career Pathways

Calvin Briggs and Bruce Crawford—both of Lawson State Community College

Lawson State Community College currently has two grants designed to create pathways into professional careers in science, technology, engineering, and mathematics (STEM) through awareness activities, field experiences, teaching and learning through problem-based learning concepts, and the establishment of a college bridge program at Lawson State Community College (LSCC). The 2-Pi STEM Program and Georgia-Alabama Louis Stokes Alliance for Minority Participation (GA-AL LSAMP) at Lawson State has given students, teachers, and educational partners the opportunities to capitalize on their roles in the development of STEM career pathways.

Additionally, faculty involvement in the partnership has increased their academic, technical performance, and knowledge of STEM careers. The projects have spanned more than eight-years with funding from the National Science Foundation, Association of Public Land-Grants, Lawson State Community College, educational partners, and business/industry. The three primary goals, identified to increase student recruitment and persistence in STEM career pathways was the establishment of 1) a mentoring program to address cross-curricular mentoring and learning communities for STEM students with an emphasis on improving STEM persistence and efficacy in STEM courses; 2) provide STEM enrichment and academic enhancement programs for high school and undergraduate students; 3) the establishment of the STEM Bridge Pathways to College Project.

E02: Increasing Retention and STEM Persistence at an HBCU

Christen Priddie, Mark Harris, John Fife, Cheryl Talley, Oliver Hill, and Katherine Palmer—all of Virginia State University

Within the United States, minorities are less likely to graduate in 4 years, earn overall lower GPAs, and are less likely to earn a degree in a STEM discipline (National Center for Science and Engineering Statistics, 2013). In this present study, we describe an intervention called Project Knowledge designed to translate positive beliefs into an academic behavior change for college freshmen attending a minority serving institution. The intervention is based on Phenomenological Variant Ecological Systems Theory (PVEST), which is a conceptual framework that includes reference to the unique sociological context in which minority children are educated and, with the current study, is aimed at increasing resilience in African American students. Thirty-seven incoming freshmen honors and non-honors STEM majors at a small urban HBCU were required to attend a one week intensive intervention called "Transition to College" or T2C. This part of the intervention took place one week before the start of the semester, and participants lived on campus during this time. T2C consisted of activities aimed at creating communalism among the participants, building an academic identity, and was the motivation for habit formation. Additionally, participants were matched with a mentor that shared the same or similar major and all activities during T2C were centered around mentor groups. After T2C, participants were required to meet weekly for one hour for 10 weeks during their first two semesters at the university. These weekly meetings featured check-ins between mentors and mentees, reiteration and expansion on the academic skills introduced during T2C, and focus on building self-efficacy and motivation to succeed while building habits that could be maintained through matriculation. The intervention placed more emphasis on affective factors and less on remediation. Results indicated that the intervention increased the retention of African American student participants by 12% when compared to the general population of the university. Results also revealed that participants were less likely to switch majors (stem to non-stem) than members of the general population and had an average GPA of 2.78 for the first three semesters. These findings were consistent with our hypothesis that an intervention that focused on emotional development and agentic behavior would result in changes in academic habits.

E03: First Semester Performance of STEM Students in a College Transition Program

Edward Mosteig—Loyola Marymount University

The College of Science and Engineering at Loyola Marymount University (LMU) initiated a program—A Community Committed to Excellence in Scientific Scholarship (ACCESS)—in 2009 to promote retention and success among first-generation and under-represented students in STEM fields. ACCESS is a learning community for 18 students of different majors in engineering and the sciences, which places particular emphasis on the first year experience. Similar models of an academic support network have been implemented in numerous settings, and have proven to be

successful in increasing retention and promoting academic excellence among populations of first-generation and under-represented students.

ACCESS provides an opportunity for incoming first-year students to participate in a one-month summer residential program that immerses scholars in a collaborative environment that focuses on academics and critical thinking in the sciences. During their first academic year, students enroll in a First Year Seminar that builds on their summer academic experience and deepens their connections with one another, and helps them expand their knowledge of—and inclination to take advantage of—a broad set of resources on campus. It appears likely that the program has had a positive impact on students' academic performance during the first semester of college.

Students in the program have higher GPAs than their peers in their first semester, either when measured against (i) students from the same demographic or (ii) students from the college overall. ACCESS scholars also show an increase during the summer of (i) a sense of belonging, (ii) confidence in math and science, and (iii) pro-social skills in scientific scholarship, all of which can contribute to student success. At the midpoint of each semester, faculty at LMU report grades for those students whose performance falls below a satisfactory level. Although the proportion of ACCESS scholars with midterm deficiencies in their first semester of college is comparable to the remainder of the other first-year students, a significantly greater proportion of the ACCESS scholars were able to convert their deficiencies into passing grades by the end of the semester.

E04: The University of Texas-Pan American RISE Program: The Success and Challenges of Implementing a New Program to Diversify the Scientific Workforce

Stephanie Segura, William Donner, and Robert K. Dearth—all of University of Texas-Pan American

The University of Texas-Pan American (UTPA) is a Hispanic serving institution located in area of southern Texas known as the Rio Grande Valley (RGV). Situated 10 miles from the U.S.-Mexico border, the institution is in one of the fastest growing (93% Hispanic) metropolitan areas in the nation. UTPA ranks 5th among universities in the number of Hispanics enrolled and undergraduate/graduate degrees (Masters) awarded to Hispanics. Despite the growing number of UTPA graduates each year, those that have pursued and obtained a Ph.D. in behavioral or biomedical sciences is alarmingly low. Therefore, in 2012, UTPA established a NIGMS supported Research Initiative for Scientific Enhancement (RISE) Undergraduate Training Program (or UTPA RISE Program). The overarching goal: to increase the number of UTPA students that graduate, pursue PhD degrees and complete them. Briefly, the UTPA RISE program recruits 6 undergraduates each year to conduct laboratory research and participate in a series of career development activities and workshops (available for all students) that prepares them for graduate school. The data presented represents independent surveys conducted over the first 3 years of the program. This is a summation of our foundational assessment of program success based on: graduate school acceptance; student perceptions; participant's scholarly achievements (papers, presentations, academic success,); impact of external research experiences, and new institutional activities and workshops (data review, seminars, career day; work life balance; how to apply to graduate school). Included are identified challenges in successfully recruiting and engaging a naive student population. Furthermore, we established baseline community and institutional data in order to determine awareness of research endeavors at UTPA; interest in and understanding of a graduate education; and the effectiveness of the RISE program as it develops in coming years. While still in its infancy, the UTPA RISE program has had a tremendous impact on the students in the program as well as the institution. It has paved the way to the development of new courses and more students pursuing graduate degrees. Overall, the impact of this program and the foundational activities will increase the number of undergraduate and master students that engage in science at UTPA and as a long-term goal the participants will pursue independent careers in research diversifying the scientific workforce.

E05: Confirming Reliability and Validity of a Self-Regulated Learning Measure for African American Students in STEM

Ontario S. Wooden, Caesar Jackson, Sherry Eaton, and Vinson J. Goldman—all of North Carolina Central University

Introduction. One continuing challenge for STEM education at North Carolina Central University (NCCU) is that many of the students entering the university come from academic backgrounds with less effective preparation for college STEM course taking. In particular, NCCU serves a range of students who score significantly less than the middle 50 percent of all college-bound seniors in North Carolina and the nation. Research indicates that self-regulated learning may be a key enabler of student academic success and has also shown that self-regulation for learning can be taught and can enhance academic achievement and a sense of self-confidence or efficacy. However, little is known about self-regulated learning in an HBCU (historically black colleges and universities) context. Therefore, the purpose of this project is to investigate the effect of self-regulated learning training and development on student success in STEM at NCCU. The Motivated Strategies for Learning Questionnaire (MSLQ) will be used to assess self-regulated learning (SRL) strategies. However, the MSLQ was developed on a student population whose demographic characteristics are substantially different than the student population at NCCU—an HBCU. The MSLQ was developed in 1988 on a sample of 354 Midwestern college students attending a public, four-year university and 24 students attending a community college (N=378). The sample was 50.5% female, 26.3% male, and 23.3% missing; 66.3% Caucasian, 3.7% African-American, 1.1% Hispanic-Spanish speaking, 2.4% other, and 24.2% missing. Eighty-nine (89) of the students completing the MSLQ at this stage were not given the demographics sheet to report data such as race and gender. The NCCU student population demographics are 67% female and 33% male; 78% African-American, 12% White, 1.8% Latino/Hispanic, 1.2% Asian, and 0.007% International. Although numerous studies have been conducted utilizing the MSLQ, there have not been any to date with a study population consistent with that at NCCU. Therefore, prior to conducting research on SRL in STEM education at NCCU, we conducted a preliminary study to establish the psychometric properties of the MSLQ for our study population (STEM students who attend NCCU) to establish the reliability and validity which would result from use of the MSLQ instrument.

Measures. The MSLQ is a self-report measure composed of motivation and learning strategies scales (Pintrich, Smith, Garcia, and McKeachie, 1991). There are 81 items making up 15 separate scales on the MSLQ. There are six motivation scales (MS) in which 31 items measure students' goals, value beliefs about the course, their beliefs in their efficiency to succeed in the course and concerns regarding the tests related with the course. There are nine learning strategies scales in which 31 items measure the different cognitive and metacognitive strategies of students and 19 items measure resource management strategies.

Participants. Participants for the preliminary study were STEM majors recruited from their STEM courses at North Carolina Central University. The ethnicities of the STEM undergraduate student body are approximately 86% African American, 5% White, 1.5% Asian, 1% Hispanic, 0.5% American Indian, 1% Non Resident Alien, and 4.5% Other. African American females are 53% and African American males are 34% of the STEM undergraduate student body.

Method. The specific STEM courses that were targeted include MATH 1100 College Algebra and Trigonometry, Math 1410 PreCalculus, Math 2010 Calculus; CHEM 1100 General Chemistry I; PHYS 2110 General Physics I and PHYS 2305 General Physics for Scientist and Engineers I. The courses are selected because they are required in many of the NCCU STEM degree programs and also because many times the rate of DWF grades in these courses exceed 30%. Participation in the preliminary study was voluntary and research personnel administered the survey during class sessions before midterm of Fall Semester 2014. Demographic information and student academic

data such as course grades, grade point averages (term and cumulative), and hours earned and attempted will be collected on each participant at the end of the semester.

Data Analysis. In an effort to determine the internal reliability and concurrent validity of the MSQL, Statistical Package for Social Sciences (SPSS) software will be used. Descriptive statistics will also be conducted on the demographic information. The correlation matrix for the MSLQ will be tabulated and the Cronbach's Alpha for each scale will be computed to measure internal consistency and reliability. Confirmatory Factor Analysis will be performed to assess construct validity. Predictive validity will be measured by correlating scale scores on the MSLQ with final grades in the STEM courses. Local norms for the MSLQ will be developed subsequently for the different STEM courses at NCCU.

E06: Increasing Underrepresented Students in STEM through an Authentic Research Introductory Biology Laboratory Course

Michael S. Gaines, Jane L. Indorf, and David P. Janos—all of University of Miami

The Howard Hughes Medical Institute-funded introductory biology laboratory course at the University of Miami (UM) was developed to expose students to scientific research during the first year of their undergraduate career. Because UM has an underrepresented student enrollment of 50%, the lab has the potential to diversify the students seeking research careers. Instead of the traditional 'cookbook' style labs in which there is an expected outcome, students perform their own inquiry-based group research project led by a multi-generational team consisting of a research faculty mentor, graduate student, and advanced undergraduate peer facilitator. The research projects are based on the faculty mentor's research, but allow students to investigate their own hypotheses and design their own experiments. This creates a sense of ownership over their research and connects each student on a personal level with the process of real scientific inquiry. Student research projects have focused on topics such as population genetics, symbiosis, gene expression, and behavioral ecology.

Based on 10 years of data, we have found that students who take these labs are twice as likely to have subsequent individual research experiences as students with matched SAT scores who take the traditional introductory biology labs. Each semester we use David Lopatto's Classroom Undergraduate Research Experience (CURE) survey to evaluate UM's authentic research biology labs. Students who take this laboratory course make larger gains in research-related skills compared to all other students surveyed. Both formative and summative data show that these labs are highly successful in increasing student engagement in STEM. With this success, we have now expanded these labs to include more students and integrated the course with chemistry, so that students are exposed to the interdisciplinary nature of scientific research. Additionally, we are implementing this course at Miami Dade College to provide underrepresented and economically disadvantaged students with these early authentic research experiences that increase their persistence in STEM.

E07: I-CUBED, RISE and BUILD Programs at Xavier University of Louisiana

Maryam Foroozesh, Loren J. Blanchard, Gene A. D'Amour, and Tiera S. Coston—all of Xavier University of Louisiana

Xavier University of Louisiana is a historically Black and Catholic university that is nationally recognized for its science, technology, engineering, and mathematics (STEM) curricula. During the past decade, Xavier has ranked first nationally in the number of African Americans earning undergraduate degrees in biology, chemistry, physics, and the physical sciences. Seventy percent of Xavier's undergraduates major in the sciences, and Xavier is a national leader in the number of STEM majors who go on to receive M.D.s and Ph.D.s in science and engineering. Despite Xavier's

advances in this area, African Americans still earn less than 10% of bachelor's degrees, less than 7% of master's degrees, and less than 3% of doctoral degrees conferred in STEM disciplines in the nation. Additionally, although many highly motivated students are attracted by Xavier's reputation in the sciences, most of these students, though bright and capable, receive inadequate preparation at the secondary school level in science and mathematics and so are academically underprepared to succeed in STEM majors. The NSF-funded Innovation through Institutional Integration (I-CUBED), the NIH-funded Research Initiative for Scientific Enhancement (RISE), and the NIH-funded Building Infrastructure Leading to Diversity (BUILD) Programs are designed to address this under-preparedness in Xavier's STEM student population, and provide support for students' engagement and persistence in STEM disciplines from freshman through senior years. These Programs work collaboratively to support initiatives that revamp freshman- through senior-level STEM courses, prepare students for research careers through specialized courses and workshops, and provide pedagogical support and mentor training to faculty. The Programs support and integrate the activities of various offices and STEM initiatives in an attempt to address those factors that hinder the success of underrepresented minority students in STEM majors. The course improvement/development projects supported by the I-CUBED Program are focused on freshman-level STEM courses. The modifications serve a variety of purposes, including addition of new knowledge, enhancement of critical thinking, scientific reasoning and computer literacy skills, and the inclusion of real-world applications. The curriculum improvement projects supported by the RISE Program are focused on sophomore-level STEM courses and have very similar goals to the I-CUBED Program. The BUILD Program, which is the newest and most comprehensive program in this group, involves junior- and senior-level course development/modification designed to give students the knowledge, skills and mindset they need to become successful biomedical researchers. This program also provides needed resources to faculty, including support to improve faculty skills in teaching, advising, and mentoring undergraduate students, particularly minorities, as they move along the biomedical research pathway. Notably, the I-CUBED, RISE and BUILD Programs continue to promote and increase the effective integration of Xavier's various STEM initiatives, as well as intra- and inter-departmental communication and collaboration.

E08: A Student-centered Entrepreneurship Development Training Model to Increase Diversity in the Health Research Workforce

Cleo Hughes-Darden, Jocelyn Turner-Musa, Farin Kamangar, Gillian Silver, Payam Sheikhattari, Christine Hohmann, Michael Koban, Gloria Hoffman, Ian Lindong, and R. Trent Haines—all of Morgan State University

Strategies used to date to increase the number of individuals from underrepresented minority (URM) groups who receive doctorates in biomedical sciences have had limited success, and the proportion of URMs in health research is not commensurate with their proportions in the population. Moreover, once URM individuals graduate with a PhD, they continue to be underrepresented in and underfunded compared to the overall research workforce.

We are implementing an innovative method to address this problem: a student-centered entrepreneurship development model (rather than an apprenticeship model) to motivate and train 220 undergraduates (over 5 years) in health research. In this model, students will take ownership of their research from the start by proposing and selecting their topic, developing the methods, writing small grant proposals, and generally advancing the project, all in consultation with faculty mentors.

Coursework, co-curricular activities and training modules will help students understand the biological, psychological, and social antecedents of health problems, as well as research methods designed to understand the etiology, prevention and treatment of these problems as they engage in practical research experiences. Throughout, students will be encouraged to work in

interdisciplinary teams. They also will be provided with several types of research mentors: 1) peer and near-pear mentors; 2) research expert mentors; and 3) research skills training mentors.

As part of the entrepreneurship model, ASCEND Scholars will prepare Individual Development Plans (IDPs). IDPs are a tool to identify academic and career goals, assess the feasibility of obtaining these goals with respect to the individuals' skill-sets, and develop a plan to acquire these skills and competencies to obtain short- and long-term academic and career goals. In addition, it provides opportunities for further communication between the student and mentor.

The overall goal of the ASCEND model is to empower students to exchange ideas, identify and develop their own research topics, be creative, and take ownership of their research. Choosing this training model is supported by substantial research showing that: a) learning occurs more effectively when students are given autonomy and the ability to use their creativity, thus constructing their own knowledge; b) the next generation of biomedical/social behavioral science PhDs must: have the skills to work in interdisciplinary teams; be able to communicate well with others and with the public; and, have the ability of transferring their skills creatively to new areas of inquiry. These skills will help them succeed in both academic and non-academic settings.

In addition to training students directly, this program will promote and support robust intra-university and inter-institutional (pipeline and research partners) relationships, and interdisciplinary collaborations. Faculty will compete for intramural grants to conduct interdisciplinary research pilot projects, and to design interdisciplinary courses. The project will be evaluated to determine how successful it has been in helping students meet the hallmarks of success, and in strengthening institutional capacity for conducting health research.

E09: Improving Success in Organic Chemistry

Leyte Winfield—Spelman College

Organic Chemistry is considered to be a gateway and bottleneck course for most STEM majors. Successful completion of the course coincides with a student's ability to master the skills and concepts of the course and demonstrate critical thinking and reasoning. For the past 5 years, mediated learning strategies have been employed to enhance students' cognitive ability and confidence in utilizing chemical concepts. Concept mastery was evaluated using pre- and post-assessments. Results are compared to those of students in sections of the courses utilizing traditional methods for content delivery. Additional data on student learning outcomes and perceptions on learning was collected through surveys and observations. Not only does the information identify those activities that were most beneficial, it also provides a correlation between students' perceived value of the activities to their mastery of content. Preliminary outcomes show increased self- and peer-advocacy and a sustained motivation for science. In addition, this cohort performs modestly better on standardized post-assessments than those in traditional courses. This presentation will provide an overview of the approach and a quantitative summary of learning outcomes and behaviors.

E10: Integrating Undergraduate Minority Students as Effective Climate Change Communicators

Samer Dessouky, Hatim Sharif, Joseph Kulhanek, Carmen Fies, and Hongjie Xie—all of University of Texas - San Antonio

The University of Texas at San Antonio (UTSA), San Antonio College (SAC), and the University of North Dakota (UND) have partnered with NASA to provide underrepresented undergraduates from South Texas climate-related research and education experiences through the Climate Change Communication: Engineering, Environmental science, and Education (C3E3) project. The program aims to develop a robust response to climate change by providing K-16 climate change education;

enhance the effectiveness of K-16 education particularly in engineering and other STEM disciplines by use of new instructional technologies; increase the enrollment in engineering programs and the number of engineering degrees awarded by showing engineering's usefulness in relation to the much-discussed contemporary issue of climate change; increase persistence in STEM degrees by providing student research opportunities; and increase the ethnic diversity of those receiving engineering degrees and help ensure an ethnically diverse response to climate change. Students participated in the third summer internship funded by the project. More than 75 students participated in guided research experiences aligned with NASA Science Plan objectives for climate and Earth system science and the educational objectives of the three institutions. The students went through training in modern media technology (webcasts), and in using this technology to communicate the information on climate change to others, especially high school students, culminating in production of webcasts on investigating the aspects of climate change using NASA data

E11: Integrating a CSI Style Mass Spectrometry Lab Experiment to Improve Student Learning Outcomes in Organic Chemistry Laboratories

Michelle Waddell, Charles Bump, Godson Nwokogu, and Edmund Ndip—all of Hampton University

The Department of Chemistry at Hampton University has a strong track record of producing graduates who pursue postgraduate studies in a considerable number of STEM disciplines including biochemistry, chemical biology, toxicology, pharmacology, neuroscience and forensics. More than 80% of the graduates from Hampton University are African-Americans with a gender breakdown of 65% women and 35% men. Hampton University produces a substantial number of female graduates in the physical sciences, where women are underrepresented nationally, especially within underrepresented minorities. Improving student learning outcomes in regards to spectroscopy was the incentive to designing a new laboratory experiment for first semester organic chemistry students. Students were introduced to NMR, IR and Mass Spectroscopy towards the end of their first semester organic chemistry lecture course. As part of the second semester organic laboratory course, students were expected to solve the identity of an unknown organic substance utilizing NMR, IR and Mass Spectroscopy. Of the three techniques, Mass Spectroscopy appeared to be the least understood by the students. Consequently, a guided-inquiry laboratory mass spectrometry experiment was developed utilizing a crime scene investigation theme. This new experiment was introduced during the first semester laboratory course. Students prepared samples and analyzed EI/CI and ESI mass spectrums of the unknown samples. The EI/CI mass spectra were obtained from the National Institute of Standards and Technology (NIST) database. ESI mass spectra were generated from student prepared samples submitted to the Chemistry Department's laboratory technician who ran the samples on the Agilent 500-MS LCMS Ion Trap. The laboratory activity was designed to engage student's problem solving skills. As part of the laboratory activity, student were required: (1) to perform a parts per million (ppm) sample dilution, (2) to analyze the EI/CI and ESI mass spectra of a sample to identify an unknown and (3) to indicate the origin of location for the unknown compound.

Included in the laboratory activity was a fictional crime scene investigation (CSI) scenario. The scenario states that a forensic chemist working for the FBI crime lab in Richmond VA has been handed several articles of clothing, carpet fibers and cloths collected from a home invasion crime scene. Compounds have been extracted from the various materials and need to be tested to determine their molecular structure. In addition to identifying the unknown organic compound, lab teams were tasked with locating the source of the sample. Based upon their data, lab groups were tasked with determining at which location the unknown chemical was found. The three choices were oil refinery, paint factory or pharmaceutical pilot plant. This presentation will highlight the

impact of introducing a mass spectrometry lab experience in a first semester organic chemistry course. Assessments of student learning outcomes were performed during the second semester organic chemistry laboratory course.

The Postdoctoral Experience in Broadening Participation

F01: Recruiting and Retaining URM STEM Graduate Students

Rhonda Fowler—Texas A&M University

Professoriate- Transformation (AGEP-T) Collaborative Research: Advancing Interdisciplinary STEM Graduate Education in Energy and Sustainability Disciplines program was designed to open multiple paths to the doctorate and professoriate for URM populations by successfully developing and sustaining large-scale, distributed, yet interconnected STEM communities among the diverse Alliance institutions that increase participation, reduce barriers, and promote success of URM doctoral students preparing for careers in the professoriate. The Alliance is led by five institutions granting Ph.D.'s in Science, Technology, Engineering and Mathematics (STEM) that include Texas A&M University, Prairie View A&M University, Texas A&M University-Corpus Christi, Texas A&M University-Kingsville, and West Texas A&M University. The overall goal of the TAMUS AGEP program is to increase the number of students from underrepresented minority (URM) populations working to complete their doctorates in energy and sustainability and/or STEM fields and subsequently transitioning to competitive postdoctoral and/or faculty positions.

Over the course of the project the short-term operationalizable goal is to develop, implement and assess a set of transportable strategies to ultimately increase the number of successful URM STEM faculty by increasing the number of URMs who enter participating doctoral programs, the percentage of URMs completing STEM doctoral degrees, and the number who transition to faculty positions (or to competitive postdoctoral positions), and by reducing their time to doctoral degree. The project's four objectives are detailed below.

Objective 1. Increase the number of underrepresented minorities (URMs) entering STEM doctoral degree programs at TAMUS AGEP institutions.

Objective 2. Reduce the average time to degree for the TAMUS AGEP Alliance URM STEM doctoral students, and increase the percentage of students across the Alliance completing their doctoral degree programs in five years.

Objective 3. Provide the AGEP Alliance students with the preparation necessary to compete for faculty positions and increase the number of URMs transitioning from STEM Ph.D. programs to faculty or competitive postdoctoral positions.

Objective 4. Foster TAMUS research collaborations to support Alliance-wide collaboration with undergraduate, master's, and Ph.D. student researchers that will result in an increase in the number URM STEM doctoral research dissertations co-advised by faculty from at least 2 partner institutions.

The poster will include a description of the TAMUS AGEP-T model and will be followed with activities designed for each objective.

F02: CIC Professorial Advancement Initiative: Challenges and Opportunities to Mentor Under-represented Minority Postdocs Transition into the Professoriate

Aman Yadav, Cristina Soto, Mark Smith, Amber Marks, and Kathy Dixon—all of Michigan State University

Despite making up 28.5% of the total population in the United States, underrepresented minorities possess 9.1% of science and engineering jobs held by college-educated Americans (National Research Council, 2011). The changing demographics in the U.S. also provide compelling motivation to address under representation in the science, technology, engineering and math (STEM) fields. While African Americans, Hispanic Americans, American Indians, Alaskan Natives, and Native Hawaiians comprise 28.5% of our national population, they represent just 9.1% of college-educated Americans in science and engineering occupations (NRC, 2011), hold only 7.9% of STEM faculty positions at universities and four- year colleges (AIR, 2009), and are significantly underrepresented in high-end research. In 2006, only 5.3% of NIH and 6.5% of NSF principal investigators were minorities (NRC, 2011). By 2050, it is projected that the present majority population will be in the minority (Bernstein and Edwards, 2008), which means that the U.S. scientists and engineers needed to maintain the U.S. STEM workforce will have to come from the groups that are currently in the minority. Having a critical mass of minority faculty in a discipline positively impacts URM enrollment. URM faculty serve as role models to minority students, which helps them persist in completing their degree programs (Jayakumar et al., 2009). If a minority student sees others of their cultural background in successful positions, it signals that they too can be successful (Plata, 1996; Hagedorn et al., 2007). The goal of our current work is to create and cultivate a mentoring-based professorial advancement initiative for underrepresented minority postdocs at CIC (Committee on Institutional Cooperation) institutions, with the mission of training a new generation of exceptionally well-prepared scholars to populate the CIC faculty ranks.

The first step in this direction is to better understand challenges underrepresented minority (URM) students face in STEM fields as they transition into the professoriate. We interviewed URM postdoctoral students to better understand their experiences in STEM fields. Qualitative analysis of 19 initial participant interviews revealed URM postdocs face a number of challenges in STEM fields including, feeling disconnected from the field, feeling different, juggling different priorities, and difficulty of balancing work and family obligations. URM postdocs also discussed that there are challenges to being successful in academia that include difficulty preparing manuscripts, challenges in securing funding, and exhaustion from collaboration. URM postdocs also brought up positive aspects about their experiences in STEM disciplines, such as support received during a postdoctoral position included positive treatment, good feedback, and support from supervisors, collaborators, mentors, and teammates. The proposed poster will present our findings.

F03: Career Outcomes from a Minority Postdoctoral Cohort – the DiverseScholar Doctoral Directory

Alberto I. Roca—DiverseScholar; and Edward Krug—Medical University of South Carolina

The postdoctoral condition as a poorly designed career training stage is receiving renewed attention. The National Academies has released a new report (Postdoctoral Experience Revisited). The discontent among trainees has been picked up by mainstream media (Boston Globe) especially publicizing recent town halls organized by postdocs (Future of Research Symposium). However, the topic of diversity has been missing from these conversations.

Minority postdocs are an underserved community at a vulnerable career stage representing a significant leak in the science-training pipeline. Any minority postdoc who does not secure a professional position after completion of their training represents a tremendous loss in the national investments made in diversity initiatives. Note that the actual talent pool for a STEM Assistant

Professor job opening is the postdoctoral population and not the K-16 student cohorts that enjoy the majority of attention from diversity intervention practitioners and scholars.

We report the career outcomes from two databases of diverse postdoctoral trainees -- the MinorityPostdoc.org email listserv (1000+ individuals) and the DiverseScholar CV Doctoral Directory recruiting database (sample size 200+). Only the latter dataset has comprehensive demographic and career outcome results since individuals responded to our surveys. The email listserv began in 2004 and has been updated continuously whenever a postdoc's email account becomes inactive. Through our live and virtual networking over 10 years, we have found some of these postdoc alumni and have recorded their career move after the postdoc. By contrast, the Doctoral Directory has a more interesting career outcomes dataset since individuals reported in a 2012 survey their desired career choice. Now years later, we can compare a survey respondent's career outcome with their intended goal. For example, 35% of Doctoral Directory postdocs had expressed interest in an academic career while 18% wanted an industry job. We will report on the job outcomes from these same respondents. Examples of the current job titles found from both datasets include: Administrator; Analyst; Cartoonist; Consultant; High School Teacher; Lecturer; Manager; Medical Student; ([Adjunct/Visiting] [Assistant/Associate]) Professor; Policy Analyst; (Staff) Scientist.

We will compare our postdoctoral alumni outcomes to those of strategic diversity interventions. Motivated by the goal of diversifying their faculty population, university senior leadership have created institutional postdoctoral fellowship programs funded by the offices of the Chancellor/President or Provost. These postdoctoral fellows serve in roles similar to visiting faculty with the expectation that home departments hire them for full-time tenure-track positions. Similar fellowships are created through external funds such as from the National Science Foundation (NSF). Representative institutional programs include a system-wide campus (University of California), a flagship school's Postdoc Office (University of North Carolina at Chapel Hill), and an NSF-funded fellowship (University of Maryland, Baltimore County). Two of these programs (UC & UNC) have existed for 30 years and so are rich sources of postdoctoral alumni outcomes which, as expected, are mostly placements in tenure-track faculty positions.

Transitions from 2 to 4-year Colleges: Determinants for Success

G01: A Research Internship Program for Community College Students: A Summative Evaluation

Jan Hodder, Jude Apple, Coral Gehrke, Michael Hadfield, and Itchung Cheung—all of Oregon Institute of Marine Biology, University of Oregon

Community colleges are an important pathway for students intending to complete a baccalaureate degree, particularly for groups underrepresented in science. Students at these institutions have few opportunities to engage in research and even fewer opportunities to explore the ocean sciences. To address this need the NSF funded Center for Ocean Science Education Excellence - Pacific Partnerships (COSEE – PP) developed the Promoting Research Investigation in the Marine Environment (PRIME) internship program. PRIME is an innovative, multi-site program that has placed 75 community college interns with 40 scientist mentors for 8-10 week residential research experiences at marine laboratories in Oregon, Washington, and Hawaii. In addition to their research, interns blog about their experience, attend seminars, and participate in activities that show the broad spectrum of research and education that take place at marine labs and associated informal science education institutions. The program culminates with a symposium during which interns give a final formal presentation of their work. COSEE PP also encourages and supports interns to present their research at local, regional, and national conferences.

A summative evaluation employing a mixed-method approach was designed to ascertain how the internships impacted students' marine science–related interest, research skills and the trajectory of students' academic and career paths. Fifty-four percent of the interns completed the summative evaluation survey and 27% of the interns participated in a structured phone interview. Closed items were analyzed using descriptive statistics and repeated-measures ANOVA. Open-ended survey items and interview responses were analyzed using a structural coding method with codes drawn from the evaluation framework which defined essential features of the internships and linked them to identified outcomes. Key findings are: 1)PRIME interns have demonstrated relatively high persistence and success in ocean science and STEM postsecondary education as compared to other CC students who transfer to four-year colleges. 2) PRIME interns reported an increase in their knowledge of ocean science, the scientific process, lab and field work, and communicating about ocean science. 3) PRIME interns reported an increase in interest, aspirations, and confidence related to ocean science and other STEM education and careers. 4) PRIME interns reported that they increased their ocean science and STEM professional networks, including those with research mentors, other ocean scientists, and science students. 5) PRIME students noted the importance of a strong relationship with their mentors who provided key support and inspiration both during and following the internship.

The PRIME students are beginning to enter science or other STEM fields, with five survey respondents in graduate school and thirteen respondents employed full- time in science fields. Interns also reported that PRIME led directly to additional research internships and jobs during their academic career. While the qualitative data provided by the findings supported a causal link between PRIME and student outcomes, the lack of a control group limits the ability to draw definitive conclusions.

Other

H01: Underrepresented Male Students and STEM Intervention Success: Extending the Theory of Planned Behavior

James M. Ellis and Dr. Phillip J Bowman—both of University of Michigan

There are a growing number of pipeline interventions funded by the National Science Foundation, the National Institutes of Health and other stakeholders designed to promote STEM careers for underrepresented students. These P-20 pipeline programs focus on all levels of education, from preschool to graduate school and careers. While STEM interventions continue to have significant success, they have been much less successful for underrepresented male students (URMS), especially African American males. For example, despite gains in postsecondary educational attainment for Black male college students, significant disparities in STEM degree and career attainment remain. Interventions such as the Summer Research Opportunity Program (SROP) provide formal programming to support minority students in their post baccalaureate educational and career goals. URMS continue to experience major difficulties in U.S. colleges and universities, especially in STEM fields. Guided by the theory of planned behavior (TPB), this study explores pivotal social-cognitive motivational factors that might explain difficulties experienced by URMS in SROP and other pipeline interventions.

More specifically, this study seeks to explore how URMS differ from others in pipeline intervention settings on pivotal TPB motivational constructs relevant to STEM outcomes – attitudes, subjective norms, perceived behavioral control, perceived control over behavior, and behavioral intentions. Going beyond the TPB, this study also builds on Blocked Opportunity models to better understand how STEM motivation among URMS may be impeded by objective and

perceived barriers to opportunity. To extend the TPB, an objective of this study is to understand how social-cognitive constructs, barriers and social support combine to promote STEM success among URMS in SROP.

Data analysis for this poster will come from an NIH-NIGMS supported study of students in the exemplary CIC-Summer Research Opportunity Program (CIC-SROP) at 12 major research universities. Descriptive and inferential statistical analysis be will conducted to explore the pivotal social-cognitive motivational difficulties faced by URMS interested in STEM careers. Practice and research implications along with policy recommendations based on study results will be discussed.

H02: Ethnography of a Meyerhoff Scholars Program Selection Weekend: T-shirts and Program Values, Breakfast and Program Goals, Parade of Stars and Lessons Applicants Learned

Mariano R. Sto. Domingo, TaShara Bailey, and Kenneth I Maton—all of University of Maryland, Baltimore County (UMBC)

The Meyerhoff Scholars Program (MYSP), now entering its 27th year, has been one of the most studied undergraduate scholars programs in the country. The program has graduated more than 900 alumni, most of whom proceeded to graduate programs in STEM. About 198 have earned PhDs as of January 2015, many of whom are underrepresented minorities. For African American students who applied between 1989 and 2008, those who accepted the MYSP offer were found to be 5.1 times more likely to enter graduate school in STEM than those who declined the offer. UMBC is now the leading primarily white university in the country producing African American students who received doctorates in science and engineering.

The success of the program is attributed to its comprehensive and multi-component framework, consisting of Advising, Summer Bridge, Selection Weekend, Study Group, Financial Award, Program Community, Program Values, Tutoring, Faculty Involvement, Research Experience, Administrative Involvement, and Parental Involvement. Aside from Summer Bridge, however, none of the other program components has received an in-depth scholarly focus. This study contributes to an understanding of the first component of MYSP that scholars are exposed to: the SELECTION WEEKEND. We begin with the question of whether the selection weekend is just a standard avenue for recruiting and selecting talented students for the program, or, conversely, its additional purposes beyond selecting the students that best fit the program.

Using ethnographic research methods that include participant observation, student surveys and key personnel interviews, and using qualitative data analysis, we will try to elucidate a) the intentions and goals of the MYSP Selection Weekend, b) the planned activities implemented and practices used by staff and others involved to pursue those intentions and goals, and c) post-Selection Weekend impacts, from the perspectives both of program staff and the student participants. Two researchers conducted observation during the first of two selection weekend events held on February 27 and 28, 2015. There were 99 applicants and their parents who participated in a series of events that started with an opening program on the evening of Friday, continued with interviews the following morning, and capped by a parent meeting and closing ceremony on Saturday afternoon.

The observations captured the messages the program communicates to applicants and their families, including a) the cohort mottoes printed at the back of the current Meyerhoff students' t-shirts, i.e. "We become our expectations," b) the content of the after-breakfast exchanges between Meyerhoff alumni and applicants about the former's Meyerhoff experience and how they benefit them in graduate school, and c) the sharing of lessons learned and weekend highlights during the "Parade of Stars," an MYSP Selection Weekend innovation in which the applicants talk on stage about themselves, their achievements and what they learned from the weekend. Pre-weekend interviews with program staff focused on the formal goals and intentions of Selection Weekend and

the plans for the 2-day event. Finally, the student survey administered provides information on applicant demographics, interest in STEM and other relevant characteristics. Taken together, the various sources of data provide insight into the nature and multi-faceted impact of Selection Weekend, the entry experience of future Meyerhoff scholars.

H03: Integrating targeted Core Competencies with Biology, Chemistry and Physics Course Assignments using E-portfolio

Na Xu, Joby Jacob, Jennifer Vance, Kevin Mark, Allyson Sheffield, Ian Alberts, and Jaime Nieman—all of LaGuardia Community College (CUNY)

Competencies are a combination of the knowledge and skills needed to effectively perform a role in a society. Developing core competencies and abilities in specific areas, including inquiry and problem solving and oral, written and digital communication, is a crucial part of community college education to help students become critical thinkers and informed responsible global citizens. This work showcases a departmental and college wide collaboration to integrate core competencies with Biology, Chemistry and Physics course assignments using E-portfolio. In response to a college wide effort, we developed a series of meetings, activities and professional development (E-portfolio) workshops to promote a department wide revision of assignments to target new college competency rubrics. The objective of this work is to improve student core competencies through a variety of assignments. Here we showcase three sample assignments for Chemistry and Physics courses, targeting competency development in problem solving and oral, written and digital communications. LaGuardia Community College is a minority serving-community college of CUNY (City University of New York) system. Our institution has been the leader in using E-portfolio in curriculum development. This practice not only helps student develop important skills and abilities in learning, but also sheds light on helping community college students, especially the minority students, in the critical transition to senior college institutions.

H04: Eliminating Inequality: Using a Self-affirmation Intervention to Increase the Performance of Underrepresented Minority Students in Biology

Hannah Jordt, Sarah Eddy, and Scott Freeman—all of University of Washington

Evidence suggests "high-structure" course formats that incorporate a large amount of active learning and frequent formative assessments (e.g. daily reading quizzes, weekly practice exams, and in-class clicker questions) can disproportionately benefit underrepresented groups in college STEM classes. Other studies indicate that small psychosocial interventions can lead to a reduction in the achievement gap via the alleviation of stereotype threat (the fear of being judged based on negative stereotypes of one's group). In this study we suggest that a combination of both strategies can eliminate the achievement gap experienced by underrepresented minority (URM) students (i.e. African Americans, Latinos, Native Americans, and Pacific Islanders) in an introductory biology course.

Biology 180, a large-scale (~700 student), introductory biology class at the University of Washington, has a "high-structure" design format. In previous quarters, this strategy has been effective at reducing the achievement gap experienced in this course for some historically underrepresented groups. To reduce the gap still further, we implemented a version of Cohen's values affirmation intervention during three separate quarters. This intervention has been shown to effectively reduce stereotype threat. In the treatment, students spent approximately 15 minutes writing about values that were most important to them from amongst an established list. Students in the control treatment wrote about values on the list they felt were least important.

Using linear regression and controlling for a measure of student ability, we found that assigning this exercise twice, spaced five weeks apart, increased the exam achievement of URM

students by 2.4% above URM students in the control treatment. This increase in performance due to the values affirmation intervention closed the achievement gap between White and URM students matched by ability. There was no effect of the intervention for women, Asia or White students. In summary, our treatment significantly eliminated the achievement gap between URM and non-URM students against the backdrop of a high-structure course. Our results suggest that instructors and institutions should consider using these intervention strategies when designing courses and enacting policies in order to promote an environment that is optimally conducive to all learners.

H05: The National Research Mentoring Network (NRMN): Mentoring to Diversify the Biomedical Workforce

Christine Pfund, Jamboor K. Vishwanatha, David A. Burgess, and Kolawole Okuyemi—all of University of Wisconsin-Madison

Effective mentors can provide guidance to emerging scientists regarding career options and opportunities within the NIH-supported biomedical workforce facilitate development of the necessary experience and skills needed for successful biomedical research careers. Yet, the lack of adequate mentoring is a problem for trainees at all stages in their career path.

The National Research Mentoring Network (NRMN) is a nationwide consortium designed to enhance the training and career development of individuals from diverse backgrounds, communities, and cultures who are pursuing biomedical and behavioral, research careers through enhanced networking and mentorship experiences. A primary goal of NRMN is to address the inequities in the full participation of biomedical research by underserved populations. Though scholars from disadvantaged backgrounds, whether by race, ethnicity, socio-economic status, sexual orientation, or disability, have demonstrated scientific curiosity and overcome many barriers to attain the proficiencies required for a career in the biomedical workforce, they still carry the burdens of disadvantage and discrimination. By facilitating long-term, culturally responsive interactions among mentees and mentors, NRMN is working to establish a sustainable process whereby diverse mentees successfully progress in their research careers, becoming the effective mentors and scientific leaders of tomorrow.

Working synergistically through four Cores: Administrative, Professional Development, Mentor Training and Mentorship and Networking, NRMN is striving to increase the participation and success of underserved groups in biomedical research. The NRMN consortium brings together leaders in novel, evidence-based strategies for forming and maximizing mentoring relationships. Specifically, NRMN is 1) developing a highly networked set of motivated and skilled mentors from a variety of biomedical research disciplines matched to mentees from the undergraduate to early career faculty level across the country; 2) developing best practices for mentoring; 3) providing training opportunities for mentors and mentees, 4) providing networking and professional development opportunities for mentees; 5) addressing the lack of full participation of underrepresented minorities across all biomedical, behavioral, clinical and social science research careers.

The overall structure of NRMN, implementation timeline and available resources, and opportunities for partnership will be presented.

This work is supported by NIH grant U54MD009479

H06: Mentor and Mentee Perspectives on Race/Ethnicity and Gender in Biology Research Mentoring Relationships

Angela Byars-Winston Patrice Leverett, Christine Pfund and Janet Branchaw—all of University of Wisconsin-Madison

Research has shown that mentored undergraduate research experiences can beneficially impact the career trajectories of women and racial/ethnic minorities being trained in science, technology, engineering, and mathematics (STEM) and that research mentoring relationships are an essential component of these experiences. The effectiveness of these research mentoring relationships are often complicated by cultural diversity factors, such as gender and race/ethnicity, which are commonly not addressed in science disciplines where objectivity is highly valued. Perceptions of how factors such as gender and race/ethnicity may influence the research mentoring relationship have remained largely unexamined. Thus, the purpose of this qualitative study was to investigate how mentors and mentees, who are engaged in laboratory or field-based biology research, experience and understand cultural variables, namely race, ethnicity (referred together as race/ethnicity hereafter), and gender, in their research mentoring relationships. Interview data from mentor and mentee participants were collected from responses to four questions regarding the role of culture in their mentoring relationships: 1) Does gender play a role in the mentoring relationship? 2) Does race/ethnicity play a role in the mentoring relationship? 3) Should you address culture directly in the mentoring relationship? 4) Should you intentionally draw on cultural diversity in the lab? Interview transcripts were analyzed using phenomenological methods. The themes that emerged will be presented, describing both the content of participants' experiences and their beliefs about their experiences, as well as nuances in how participants responded to the questions. Although similarities were present, the perceptions of mentors and mentees were not always aligned. Implications of the findings for policy and training interventions to enhance the effectiveness of research mentoring will be discussed, with the goal of positively impacting the retention of female and underrepresented racial/ethnic minority students pursuing science careers.

H07: Integrative Learning: A Model for Student and Faculty Development

Jill J. Keith and Tennille D. Presley—both of Winston Salem State University

We will present results from a pilot involving Integrative Learning in the General Biology I course since many students who learn basic biological concepts have difficulty connecting them to other disciplines. Thus, certain concepts of physics were incorporated into the course, including metabolism, cell communication, cellular respiration, and biomolecules. The students' knowledge and their beliefs towards biology were assessed using AACU's "Integrative Learning VALUE Rubric" and the Colorado Learning Attitudes about Science Survey (CLASS) to connect indirect and direct assessments. For comparison, these same assessments were given to students in a General Biology class that did not use Integrative Learning. We learned that there are some correlations with the students' attitudes towards the subject and their overall understanding of the material. For example, statistical significance ($p<0.05$, chi squared test) was evident between the two groups when surveyed for their passion towards science, cognition, and integrative thinking).

The results were shared with Winston Salem State University's faculty from various disciplines at a Faculty STEM Institute. These Institutes allowed us to receive insights concerning the data from colleagues in psychology, chemistry, biology, physics, math, behavioral sciences, education, and nursing. They also served as a venue for forming interdisciplinary partnerships.

Our next steps are to track the General Biology students as they progress into other science courses, to ensure faculty use this model, and form new collaborations within and across disciplines.

H08: Preparing Critical Faculty for the Future: A Professional Development Program to Enhance STEM Education

Louise Wrensford, Rhonda Porter, Janis Carthon, Hema Mason, and Joyce Johnson—all of Albany State University

Effective professional development to enhance knowledge of evidence based teaching practices among faculty and for successful implementation of these strategies as integral components of courses, is essential to transforming teaching practices for enhanced student learning and retention in STEM. With the heavy teaching loads and commitments that exist at many institutions especially HBCUs, this is an on-going challenge. The establishment of the NSF funded Preparing Critical Faculty for the Future (PCFF) program at the institution to implement an effective faculty development program in this existing environment will be described. The professional development model components include instructional planning, implementation, assessment and continuous faculty support utilizing faculty mentors and technology integration. This model is moving the institution forward towards transformational change in how STEM is taught at the institution. Assessment of program components including faculty training and implementation shows an overall positive impact on faculty and students. Ways that institutions can leverage resources to sustain professional development efforts, to encourage faculty and to increase faculty use of these strategies will also be discussed. Participants will gain information on components of an effective professional development model as well as strategies that can be implemented in courses to enhance student learning and retention by other institutions.

H09: Preparing Critical Faculty for the Future: A STEM Faculty Learning Community for Online Course Instruction

Gail P. Hollowell, Yolanda B. Anderson, and Carlton E. Wilson—all of North Carolina Central University

North Carolina Central University (NCCU) is the nation's oldest public liberal arts institution for African Americans; an institution with a strong tradition of teaching, research, and service. Many of the students entering the university come underprepared in the basic mathematics, science, and general education courses, necessary for persistence to the STEM degree. Thus, new approaches are needed to address basic mathematics, science, and general education course requirements of our entering freshmen in order for them to become successful learners (Saritas and Akdemir, 2009). Whereas student success is paramount, the professional preparation of faculty members to effectively communicate and transfer information to students is also essential. This becomes especially important as institutions like NCCU place increasing emphasis on online course delivery as a means to accommodate increasing course enrollment in the face of constraints on physical infrastructure. Recent studies have shown that students had an advantage in the online environment +0.40 ($p < .001$); when they were exposed to a different curriculum and/or instructional methods from students in the face-to-face condition. When these factors were equivalent across the online and face-to-face conditions, it was +0.13 ($p < .05$). This finding suggests that the positive effects of using online technology in education are enhanced when an instructor adapts curriculum and instructional approaches to the use of technology (Means, 2010). Over the past decade, faculty learning communities have emerged as a practical and pedagogically sound approach to address the challenges faced in higher education today (Shapiro, et. al., 1999). To that end, NCCU created at faculty learning community comprised of 10 STEM faculty from 4 disciplines - Biology, Chemistry, Mathematics, and Environmental, Earth, and Geospatial Science. All faculty completed a 2 week online Quality Matters (QM) 'Applying the Quality Matters Rubric' introduction course and participated in a STEM higher education conference to enhance their effectiveness for their online instruction. Outcomes measured compared QM online STEM courses vs non-QM online STEM courses vs traditional face-to-face classes.

H10: Teaching Tools for Improved Learning and Retention in Organic Chemistry

Steven A. Fleming, Chung Tran, Quianna Enang, and A. Baris Gunersel—all of Temple University

The D/F/W/I rate for the traditional organic chemistry course is high and the class grade point averages (GPAs) are typically low. Recently the Temple University classes' GPAs for organic chemistry have increased. We will discuss the reasons for the change. In spite of our efforts to help all students move forward in the chemistry major, the subject of organic chemistry remains a roadblock for too many students. Efforts to develop teaching tools for organic chemistry have resulted in students gaining a better understanding of the material. This improvement in learning has been measurable, but the improved learning may not be sufficient to retain all STEM majors. The ultimate goal for the new tools is to enhance critical thinking and the role these tools play in improving critical thinking is more difficult to assess. Our measured improvement in learning and other efforts directed at improved STEM teaching at Temple University will be addressed.

Symposia Abstracts

S01: Strengths-based STEM Interventions for Underrepresented Students: Understanding Strong Program Elements and Student Barriers

Chair: Phillip Bowman—University of Michigan

Strengths-Based STEM Interventions: Meyerhoff Scholars Program and Beyond

Kenneth Maton, Mariano R. Sto, Domingo, Patricia Esparza, Rukiya Widerman, and Freeman A. Hrabowksi, III—all of University of Maryland, Baltimore County

Increasing the academic success of underrepresented students (URS) in the STEM fields is a pressing national priority. Progress in this area both contributes to national competitiveness in the global economy and promotes our country's social justice agenda. The Meyerhoff Scholars Program at the University of Maryland, Baltimore County (UMBC) is an evidence-based and highly successful strengths-based intervention program that contributes to these priorities. As a national model, the Meyerhoff Program's radiating influence at UMBC and on campuses around the country can help to further clarify core supportive elements of an exemplary strengths-based STEM intervention for URS. Kenneth Maton et al.'s presentation summarizes key aspects of the Meyerhoff Program model, and then to move beyond the program per se, depicts its radiating effect on the UMBC campus more generally, and on strengths-based interventions around the county.

Formal Organizational Support and STEM Intervention Outcomes: A Strengths-Based Approach

TaShara Bailey—University of Maryland, Baltimore County

This strengths-based study provides new insight into the social organization of strong pipeline interventions for URS. TaShara Bailey's presentation summarizes recent findings on how strong Formal Organizational Support may help to explain overall program satisfaction and successful STEM career plans among URS. This NIH-NIGMS supported study revealed that URS in strong pipeline interventions with multiple program components had higher scores on strong formal organizational support scale items than URS in pipeline interventions with fewer formal program components. In summary, (1) URS with higher formal organizational support had significantly higher informal support from program peers than from either faculty mentors or program staff sources; (2) strong formal organizational support was related to program satisfaction, and (3) program satisfaction was linked to STEM research career plans. Theory-driven findings have implications for refining a strengths-based model of successful STEM outcomes, guiding future research as well as implications for program practice and policy.

Financial and Academic Barriers to STEM Intervention Success

Krystal Williams—Educational Testing Service

Although strengths-based interventions can promote STEM success, it is also important to understand how barriers faced by URS in intervention settings also influence STEM outcomes. Krystal Williams' Presentation focuses on the importance of strengths-based elements to overcome pivotal financial and academic barriers that often impede URS in intervention settings. This NIH-NIGMS supported study further clarifies social psychological mechanisms through which financial and academic barriers impede STEM outcomes. Multivariate analyses of longitudinal data on 376 URS in summer research interventions found that STEM research career plans were enhanced by strengths-based interventions, but impeded by financial and academic barriers (both objective

barriers and subjective threats). Study findings also suggest that personal resiliency, a measure of adaptive cultural strength, can promote successful STEM outcomes despite barriers. These theory-driven findings can help program administrators and policy-makers better determine not only if, but how, strengths-based interventions promote STEM success.

S02: Promising Models to Promote STEM Research Careers by Multi-Institution, Multi-Disciplinary Alliances Funded by the NSF AGEP-T Program

Chair: Mohammed A. Qazi—Tuskegee University

The AGEP-T program has been established by the NSF to encourage institutions of higher education and other stakeholders to form strategic alliances and propose innovative models to increase the quality and quantity of underrepresented minorities (URMs) in STEM graduate education, STEM postdoctoral studies and the STEM Professoriate (URMs include African Americans, Hispanic Americans, American Indians, Alaska Natives, Native Hawaiians and other Pacific Islanders). The focus of the proposed symposium is to have active AGEP-T alliances engage in dialogues on the development, implementation, study and evaluation of their respective models for URM STEM graduate education and transitions to careers in academia. The dialogue will consist of presentations by three AGEP-T alliances (led by Tuskegee University, Stony Brook University and Texas A&M University) to describe their models and associated research and evaluation activities, followed by a discussion with the audience. These research and evaluative components are critical to investigate the effectiveness of each model. They are driven by strategically formulated research or evaluation questions that are studied by using qualitative and quantitative techniques from education and the social sciences.

Each AGEP-T Alliance will describe features that make their models unique and their potential to contribute to preparing URMs that are better motivated to pursue STEM research careers. For example, the innovative aspect of the Tuskegee AGEP-T Alliance lies in the virtual nature project interventions. The uniqueness of the Stony Brook AGEP-T model is based on a strategic alliance that includes a national laboratory (Brookhaven National Laboratory) to facilitate the research productivity of their advanced URM doctoral students in STEM by providing them with a series of opportunities to learn technical competencies, develop research collaborations, and broaden their scientific networks. Finally, the originality of the Texas A&M AGEP-T model lies in the engagement of students in performing peer reviews, identifying and subsequently applying for competitive fellowship program and providing professional development to acquire skills for teaching at all levels.

The proposed symposium is organized by the "Tuskegee Alliance to Forge Pathways to Academic Careers in STEM (T-PAC)", which is the only one amongst the eight AGEP-T Alliances currently in operation that is led by a Historically Black University – Tuskegee University. All AGEP-T Alliances are spearheaded by faculty members in key disciplinary areas who are the Principal Investigators, including STEM, behavioral sciences, education and diversity. These individuals will lead the proposed dialogue during this session.

The symposium dialogue will shed light on the factors that may adversely impact the academic success of URMs, and will illuminate positive practices leading to promising strategies that can be widely adopted to gradually increase URM representation in STEM research careers.

The Tuskegee Alliance to Forge Pathways to Academic Careers in STEM (T-PAC)

Melody L. Russell—Auburn University; Shaik Jeelani and Mohammed A. Qazi—both of Tuskegee University; and B. K. Robertson—Alabama State University

T-PAC is an AGEP-T collaborative effort among three doctoral granting institutions in the state of Alabama consisting of two Historically Black Universities, Tuskegee University (TU), and Alabama

State University (ASU), and a Traditionally White Institution, Auburn University (AU). The focus of T-PAC is to recruit 18 first year URM doctoral students (T-PAC Scholars) at the three T-PAC Alliance institutions and assist them in their preparation through a promising novel model for STEM doctoral education. The novelty of the T-PAC model lies in the joint mentorship that is provided by engaging Scholars in interventions that are characterized by their *virtual* nature. These strategic interventions assist T-PAC Scholars to successfully progress through the various critical phases of their doctoral programs of study, such as passing graduate course work, preparation for qualifying examinations, carrying-out research and writing a publishable thesis.

The effectiveness of T-PAC's interventions is investigated through comprehensive research and evaluative components. Our research is grounded in the theory of Social Cognitive Career Theory and STEM Identity and is guided by the following strategically formulated research questions:

1. What factors impact STEM URMs decision to pursue careers as STEM faculty at Historically Black Colleges and Universities (HBCUs) and Traditionally White Institutions (TWIs)?
2. What factors determine STEM identity development for URM STEM graduate students?
3. Does STEM identity impact career choice and academic outcomes for URM in graduate programs across STEM disciplines?

Our presentation will start with a description of the T-PAC model and will be followed by a detailed discussion of the research that is being carried out to assess and understand the model's effectiveness. Results-to-date will be shared.

AGEP-T Frontiers of Research and Academic Models of Excellence (FRAME): Bridging Research and Practice to Promote Academic Engagement of Underrepresented Minorities in STEM Fields

Sheri Clark—Stony Brook University

Despite growing recognition that advancement of innovations in STEM fields in the U.S. is often stymied by a lack of diversity among advanced STEM professionals, members of underrepresented groups continue to encounter considerable barriers to their success in STEM fields. In addition to barriers such as reduced access to resources and fewer opportunities for mentoring, research on social identity threat highlights the prevalence of messages in the academic environment that convey low value for underrepresented groups in STEM. To address these issues, we will describe a programmatic intervention (AGEP-T FRAME) that was designed to support the development of advanced URM STEM graduate students and postdoctoral trainees in the critical areas of research productivity, professional development, and postsecondary teaching. AGEP-T FRAME supplements doctoral training by focusing on the quality of degrees, and by providing professional preparation that will permit underrepresented minority graduate students and postdoctoral trainees in the STEM disciplines to compete and succeed in the Professoriate. Our recruitment, graduate and postdoctoral training components are designed to maximize professional outcomes in highly competitive research environments, with the aim of increasing URM representation in the Professoriate at all levels. To do this, Stony Brook University has formed an alliance with Brookhaven National Laboratory to provide comprehensive training for underrepresented postdoctoral fellows in key competencies that will enhance the trainee's likelihood of successful placement in faculty positions in research-intensive institutions. Additionally, this strategic alliance provides academic integration for advanced underrepresented doctoral students in STEM to increase their research productivity by providing them with a series of opportunities to learn technical competencies, develop research collaborations, and broaden their scientific network.

Combined, these activities support our goal to increase quantity and quality of research publications produced by AGEP-T students.

Finally, we will describe results of a longitudinal social science research study that builds on this programmatic intervention by examining whether one's academic environment provides a threatening context for URM students (vs. non-URM students) in STEM that undermines URM students' persistence in their STEM fields over time. Specifically, this study examines implicit theories of intelligence, confidence, and sense of belonging, to see if these psychosocial variables predict persistence in STEM fields over time. Supporting this possibility, preliminary results demonstrate that graduate students' beliefs that their STEM colleagues believe intelligence is a fixed (versus malleable) entity may create a context of threat – particularly for members of an underrepresented group in STEM (i.e. women), impacting confidence and sense of belonging among women and leading women to consider dropping out of their STEM career pathway. A description of the AGEP-T FRAME model as well as the rationale, methods, and results of the research study that builds on this model will be discussed.

The Next Generation of Scholars: Recruiting and Retaining URM STEM Graduate Students

Rhonda Fowler—Texas A&M University

The Texas A&M University System (TAMUS) AGEP-T entitled "Collaborative Research: Advancing Interdisciplinary STEM Graduate Education in Energy and Sustainability Disciplines program" is designed to open multiple paths to the doctorate and professoriate for URM populations by successfully developing and sustaining large-scale, distributed, yet interconnected STEM communities among the diverse alliance institutions that increase participation, reduce barriers, and promote success of URM doctoral students preparing for careers in the professoriate. The alliance is led by five institutions granting Ph.D.'s in Science, Technology, Engineering and Mathematics (STEM) that include Texas A&M University, Prairie View A&M University, Texas A&M University-Corpus Christi, Texas A&M University-Kingsville, and West Texas A&M University.

The programmatic interventions that are being implemented by this multi-institutional, multi-disciplinary alliance are centered on Energy and Sustainability. These interventions will enable us to more effectively recruit URMs into the Alliance and provide the community, training, research experiences, and mentoring to promote their success and interest in pursuing careers in the professoriate. The outcomes of the interventions are being investigated through comprehensive research and evaluative components.

The conceptual framework that is used to guide the alliance's research plan is anchored around Social Cognitive Theory. The social science research study designed to gain an understanding of the effectiveness of the proposed interventions is guided by the following questions related to feelings of inclusion of URM STEM graduate students at each of the Alliance institutions in both experimental and applied settings:

1. What effect does experiencing isolation or ostracism have on the productivity and progress of URM STEM graduate students and their intentions to continue to the professoriate?
2. What factors (e.g., institutional, interpersonal, individual) promote or mediate against URM STEM students' experiencing feelings of isolation or ostracism?
3. How effectively are project activities impacting students' educational and career plans, their sense of community, and their attitudes, beliefs, confidence, and skills related to successful completion of URM STEM PhDs and continuation into faculty/post doc positions?
4. Do URM STEM students at all TAMUS AGEP-T institutions have a sense of community?
5. Are the collaborative research efforts across TAMUS AGEP-T programs and institutions impacting the success of URM STEM students?

The presentation will start with a description of the TAMUS AGEP and will be followed with discussion of the research that is being carried out to assess and understand the effectiveness of the program. Types of data collected will be described. Results-to-date will be discussed.

S03: The 2- to 4-Year College Transition

Chair: Kelly Mack—Project Kaleidoscope/ST

Factors Influencing the Persistence of Students Enrolled in S.T.E.M. Programs at Historically Black Community Colleges

Latitia D. McCane—Bishop State Community College

The majority of the research on African American students in STEM has focused on four- year institutions, even though they comprised 15% of the enrollees at two-year colleges in fall 2009, compared with 14% at four-year colleges (Snyder & Dillow, 2010). Sadly, this demonstrates that too little is understood regarding the role community colleges play in the production of STEM graduates, particularly African Americans. More tragically, is the fact that little or no quality research exists on Historically Black Two-Year Colleges' production of STEM graduates, although, research shows the largest portion of STEM degrees earned by African Americans is awarded by four-year Historically Black Colleges and Universities (HBCUs), that which has been produced tends to focus on STEM persistence at four-year HBCUs.

This presentation will discuss findings on how African American STEM students' academic and social integration on campus; interaction with other STEM students and faculty; influence their persistence in STEM at two-year Historically Black Community Colleges. The study sought to understand the experiences of African American with an associate degree through the eyes of those who completed their first year in a STEM at two-year historically black community colleges and how their lived experience might influence the academic success of future STEM participants. Utilizing Tinto's theoretical model of persistence, the study examined the experiences students' encountered through participation in STEM after the completion of their first year. The study was conducted to achieve the following two goals: (a) to determine what academic and social integration looks like for African American students in STEM at historically black colleges. (b) to assess how interactions with faculty and peers positively impact the African-American student experience in STEM pathways.

To achieve these two goals, this study examined the particular experience of African American students enrolled in STEM pathways across 5 two-year HBCUs in Alabama. The method of inquiry was a phenomenological approach designed to elicit a clear and complete understanding of how African American students attending historically black two-year colleges experience STEM. The intent of the study is to assist community colleges and universities in developing stronger recruitment and retention strategies that may yield positive results in improving African American persistence in STEM.

This study was guided by the following research questions:

1. What kind of college experiences did students acquire as a result of having participated in STEM courses?
2. How did academic integration influence persistence toward degree completion?
3. In what ways did social integration influence persistence toward degree completion?
4. What was the influence of faculty mentoring on adaptation to the academic environment of the college?
5. How did interacting with other students influence student persistence toward degree completion in STEM pathways?

Tinto's (1975) model of persistence was the theoretical framework applied to this phenomenological study to document the experiences, perspectives, and recommendations of African American students who were currently enrolled in STEM pathways at historically black community colleges in Alabama. Many studies on student persistence have utilized Tinto's theory because social integration, academic integration, student interaction, and faculty interaction are strong indicators of student success. This study proved that Community Colleges have a traditional age talent pool in STEM that is college ready. Students in this study were traditional age college students and the results of the findings indicated that they were academically and socially integrated into their college environment. Participants credit their institution, faculty, peers, and themselves working collaboratively to achieve their educational goals. All students in this study will earn their two-year degree and transfer to a four-year college or university in STEM.

URM Students are the Majority in a Hybrid Online B.S. Degree Program from a Research-intensive University

Jennifer C. Drew and Eric W. Triplett—both of University of Florida

The Microbiology and Cell Science Department in the College of Agricultural and Life Sciences at the University of Florida has developed an innovative model of a 2+2 degree program that increases participation of underrepresented minority students in a STEM degree programs. Although many two-year students have a desire to pursue a B.S. degree, due to a myriad of factors, these students to not complete the 2-year to 4-year transition, and this transfer gap is wider for URM students. Many universities in the United States, particularly research-intensive land-grant universities, are located in rural regions that are distantly located from their respective states' highly populated urban centers. This geographical and cultural distance reduces participation of otherwise highly qualified and diverse students in the STEM degree pipeline. In response to these challenges, we developed a new model of a 2+2 program that uses distance education as the vehicle to bring a university's life sciences curriculum to students rather than the oft-tried model of a university attempting to recruit URM students to its location. In this paradigm, community college graduates transfer into the Microbiology and Cell Science (MCS) program as distance education students to complete their Bachelor of Science degree. The program was established in 2011 and is the first of its kind in a STEM field, and as such serves as a model for other universities seeking to broaden the reach of their STEM programs.

The program was established in close collaboration with the 2-year institution Miami Dade College – North Campus. This strategic partnership with a large minority-serving institution allowed us to integrate one of our primary objectives from the very start: increasing URM participation in the STEM pipeline. The experience of the students in the Distance Education Microbiology and Cell Science program (DE MCS) is very similar to the on-campus students' experiences in that both groups of students take the same departmental courses taught by the same instructors, take required laboratory courses in a face-to-face format, take only proctored exams, and have the same availability to instructors. To test the hypothesis that this hybrid online approach can increase participation and diversity in the STEM pipeline, the outcomes of the DE MCS were assessed and compared to the on-campus MCS program after three full academic years. The enrollment of DE MCS majors has climbed steadily each year from the initial cohort of 11 students to a current enrollment of 79 DE MCS majors, and has contributed to an overall increase in the number of Microbiology and Cell Science majors. As of the Fall 2014 semester, over half (51%) of the DE MCS students are from underrepresented minority backgrounds. Statistical analysis of the data indicate that this level of URM participation is significantly higher than the URM participation levels in corresponding on-campus cohorts, which vary from 21-33% (p values < 0.05). The DE MCS program has comparable graduation and retention rates as their corresponding on-campus programs. Academically, the DE MCS students perform as well as, or better than their on-campus

cohorts with a mean graduation GPA of 3.50. Overall, these data indicate a hybrid online 2+2 approach is successful in increasing URM participation and strengthening the STEM pipeline. The data represents an update on the results in press in the journal PLOS ONE.

S04: Taking the Next Step: Examining Obstacles and Opportunities in STEM Career Pathways

Chair: Clifton Poodry—Howard Hughes Medical Institute

Taking the Next Step: Examining Obstacles and Opportunities in STEM Career Pathways

Christopher B. Newman, Kimberly Griffin, Kenneth Gibbs, and Tonisha B. Lane—all of University of San Diego

In this symposium, the researchers will present three empirical studies that focus on STEM career pathways. The purpose of this session is to provide the audience with a better understanding of factors contributing to underrepresented populations' educational choices and career decision-making. The presenters will focus on multiple time points in the training trajectory, addressing the early postsecondary entry points for undergraduates, students engaging in undergraduate research and/or internships with corporate industry, and postdoctoral scholars as they decide between faculty, researcher, or non-academic career roles.

Tonisha Lane will focus on the role of undergraduate research in developing a STEM identity among women scientists of color. Using interview data collected from 15 Black females and Latinas, she explores the advantages of engaging in undergraduate research. Participants reported that building relationships with faculty, engaging in scientific practices, strengthening their technical skills, preparing materials for conference presentations, and being recognized for their work solidified their identities as future scientists and engineers. These opportunities also demonstrated to the students their aptitude for graduate education and academic careers. Furthermore, this presentation will utilize social and cultural capital as analytical lenses to elucidate how participation in undergraduate research creates critical pathways to graduate education and academic careers for women of color.

Dr. Christopher Newman will present research based on a multiple case study of two predominantly White public research universities. Interviews were conducted with 70 individuals including undergraduate engineering and computer science majors, faculty, senior administrators, and baccalaureate recipients who completed their degree within 3-5 years at the time of the study. His research investigates how undergraduate experiences with corporate internships and individual's financial circumstances inform students' consideration of pursuing careers in industry. Personal finances as well as the allure of lucrative employment within corporate industry appeared to play a considerable role in participants' intent to enter the labor market instead of pursuing graduate degrees. An econometric model of investing in human capital, tempered with a social capital framework, is employed to help interpret students' decision-making processes. Drawing from multiple perspectives from students, faculty, and administrators, the presenter will discuss important implications for the future of STEM fields and the possible systematic diversion from graduate education and, subsequent, academic/research careers.

The research presented by Drs. Kimberly Griffin and Kenneth Gibbs will address career development during graduate and postdoctoral training. They will present survey data collected from 1,000 American postdocs, assessing their current level of interest in four career paths: faculty at a research university; faculty at a teaching university; researcher outside of academia; and non-academic careers. Participants were also asked to reflect on and indicate their interest in each career path before graduate school and after completing their PhDs. Analyses examined how career interests changed over time, the factors that may be shaping career interest development, and whether there were differences in patterns by social identity. Regression analyses showed that group differences in interest in faculty careers were explained by career interest differences formed during graduate school, but not by differences in research productivity, self-efficacy or advisor

relationships. This work highlights the need to attend to graduate experiences and training, and suggests scientists must be provided with career information early to have greater influence on development.

This symposium will conclude with time for questions and discussion regarding the various pathways to STEM careers, and factors that influence decision-making. Further, we will generate discussion regarding strategies and programs that could be implemented to increase diversity in various STEM career paths.

S05: Strategies with Undergraduates I

Chair: Shiva Singh

Integrated Programs Support Success and Graduation

Patricia A. Marsteller, Drew Kohlhorst, Molly Embree, Jacob Shreckengost, and Andrea Neal—all of Emory University

Integrated programs of academic support and early research are essential to developing identity as a scientist and increasing persistence of underrepresented students. Integrated undergraduate development programs are organized and conducted by the Emory College Center for Science Education (ECCSE). ECCSE promotes access, interest and participation in STEM careers, by supporting and enhancing programs in the college, the graduate school, and in the health sciences. ECCSE programs supported by Emory College and grants from HHMI and NSF have enhanced the success of over 1500 UR undergraduate students. Since 1995 the Hughes Undergraduates Excelling in Science (HUES) Program has provided guidance and support for under-represented minorities interested in science and science careers. HUES has two components: a week-long Summer Institute preceding the freshman year, followed by various activities to support participants throughout their years at Emory. During the 2013-2014 academic year, there were a total of 84 UR incoming freshmen along with 56 upper-class peer mentors that participated in HUES. More than 60% of HUES alumni continued to graduate or professional school. HUES participants have significantly higher GPAs and persistence compared to matched Emory students.

ECCSE supports collaborations between Oxford and Emory, providing faculty development of best practices in course design, assessment, and inclusive instruction. We support a pre-freshman bridge program, Getting a Leg Up at Emory (GLUE) that has served 198 prospective STEM students since 2012 (60% UR), building key critical thinking, campus resource discovery and learning community skills. Participants are evaluated and interviewed by Emory/Oxford faculty to determine scientific ability and fit for various disciplines. To date, 22% of GLUE participants have participated in our "Introduction to Research" course, semester and summer research experiences, our HUES program and our NIH funded Initiative to Maximize Student Development (IMSD) program. Approximately 75% of GLUE UR participants are interest in Ph.D. programs in biomedical sciences. Of our 2012 cohort (n=32) over 50% of program participants have declared a STEM major and our 2013 and 2014 cohorts are active in extracurricular research opportunities and continue to act as mentors to new cohorts.

Emory College students have multiple opportunities for research and many departments sponsor research for credit or work-study opportunities. The Scholarly Inquiry and Research at Emory (SIRE) Program since 2004 has placed 986 first and second year students (13% UR) in research projects in all disciplines, 70% of these in the sciences. This year the SIRE/HHMI Partners program assisted 121 (19.8% UR) students in selecting a lab, reading relevant literature and developing lab, analytical and communication skills (graduate fellows receive an additional stipend for conducting these sessions). Undergraduates then developed a proposal for semester or summer research with the lab they choose as part of the program.

Finally, the Summer Undergraduate Research Program at Emory (SURE), established in 1990, has served over 1660 students (30% UR). SURE program participants reported significant learning gains in scientific-focused ethics and laboratory skills and increases in their interest in pursuing an MD/PhD degree or PhD in a scientific field.

In conclusion, we report on the use of early interventions and research programs to aid students in successfully completing a degree in the STEM disciplines. In a recent survey of alumni who have completed their undergraduate academic degree and participated in one or more of these early interventions report 81% are employed in a STEM career (n=145), with 58% of respondents currently participating in scientific research, 81% are satisfied with their position and over 80% plan to remain in a STEM career over the next 10 years. These data show the clear value of these early academic and research events that fosters identity student as a scientist, academic success and graduate school entry.

Closing the Social Class Achievement Gap in Undergraduate Biology Courses with Values Affirmation Interventions

Yoi Tibbetts, Elizabeth Canning, and Judith Harackiewicz—all of University of Wisconsin-Madison

Objective: We will discuss intervention research designed to improve performance and persistence for first-generation students who typically struggle in undergraduate biology courses. We investigate the mechanisms through which values affirmation interventions may help first-generation college students achieve a greater sense of belonging in college courses, perform better, and continue in the field of biology.

Theoretical framework: Achievement gaps for underrepresented ethnic minority and low SES students are prevalent in American education, and it is critically important to develop interventions to close these gaps. Recently, a series of randomized field experiments has produced striking effects on student motivation and achievement. The values affirmation intervention, in which students reflect on important personal values, is a brief exercise integrated into classroom curriculum that has led to significant effects on academic performance (Cohen et al., 2006; Miyake et al., 2010). This social psychological intervention has proven to be particularly effective for minority students and for women in physics, but no prior research has attempted to close the gap for first-generation students, a population that accounts for nearly a fifth of college students. When first-generation students write about their most important values, they may bolster themselves against perceived identity threats, whether those threats are due to stereotypes about their group or a mismatch between personal and institutional norms/values. Indeed, recent research suggests that values-affirmation interventions promote a sense of social belonging or academic fit and this may be particularly effective for first-generation students who endorse more interdependent motives for attending college and who may experience a lower sense of academic belonging. Focusing on important values may help first-generation students cope with stress and uncertainty about their background, and promote more effective performance in classes.

Methods and results: We tested a values-affirmation intervention in a double-blind randomized experiment with 798 U.S. students (154 first-generation) in an introductory biology course for majors. The brief writing exercise was administered in laboratory sections of the course, early in the semester, and again in the 5th week of the course. For first-generation students, values affirmation significantly improved final course grades and retention in the second course in the biology sequence, as well as overall GPA for the semester. This brief intervention narrowed the achievement gap between first-generation and continuing generation students for course grades by 50% and increased retention in a critical gateway course by 20%. A three-year follow-up revealed that first-generation students in the VA condition continued to earn higher grades in classes taken after the semester in which values-affirmation was implemented. In our ongoing research, we are examining the mechanisms through which this intervention worked, focusing on the content of

students' writing.

Significance: Our results indicate that the values affirmation intervention can be scaled up to large enrollment science classes and can help first-generation students. Our results suggest that educators can expand the pipeline for first-generation students to continue studying in the biosciences with psychological interventions.

Closing Achievement Gaps with Utility Value Interventions

Judith Harackiewicz, Stacy Priniski, Elizabeth Canning, and Yoi Tibbetts—all of University of Wisconsin-Madison

Objective: Many students start college intending to pursue a career in biosciences, but too many minority and first-generation students abandon this goal because they struggle in introductory biology. Keeping students interested in college science courses is crucial to keeping them on track for careers in biomedical science.

Theoretical background: One way to develop interest in activities is to find meaning and value in those activities, and one type of task value that has proven to be a powerful predictor of interest and performance is utility value (UV). Recent research indicates that it is possible to promote perceived utility value with simple interventions that ask students to write about the relevance of course topics to their own life or to the life of a family member or close friend. These interventions work best for students with a history of poor performance. For example, Hulleman et al. (2010) found that a UV intervention promoted interest in a psychology class for students who had performed poorly on early exams, relative to a control group. We hypothesized that UV interventions might be particularly effective with minority and first-generation students who are uncertain about their background and preparation for college science courses.

Method and results: The utility value intervention was administered in a randomized field experiment in four semesters of an introductory college biology course. A total of 1040 students participated; 423 were majority continuing-generation students (Caucasian/Asian), 126 were minority continuing-generation (African-American/Hispanic/Native American), 427 were majority first-generation students, and 64 were minority first-generation students. This sample allowed us to evaluate the independent and interactive effects of generational and ethnic minority status. The achievement gap in this course was significant for both first-generation and minority students, and greatest for the minority first-generation students (compared to all other groups).

The experimental intervention consisted of three 500-word paper assignments, for credit, assigned during the second week of each of three 5-week units of the course. Students in the control condition wrote a summary of course material. Students in the UV conditions wrote essays describing the relevance of course material to their own lives and/or a letter describing the relevance of the material to the life of a close friend or family member. We found that the UV intervention significantly improved grades for all students, but had a particularly strong effect for minority first-generation students, relative to all other groups. These students have the "double challenge" of contending with both minority and first-generation status, and our results suggest that the UV intervention was most effective for the most challenged group.

Significance: Our results highlight the importance of supporting task values for at-risk students and further suggest the importance of considering the separate and combined effects of generational and ethnic minority status in designing effective interventions.

S06: Enhancing Success for Post Baccalaureates and Graduate Students
Chair: Richard McGee—Northwestern University, Feinberg School of Medicine

Transforming PREP Outcomes through Changes in Mentoring Approach
John David and Michael L. Garcia—both of University of Missouri-Columbia; and Anthony L. DePass—Long Island University

The University of Missouri-Columbia post-baccalaureate research education program (MU PREP) is now in its 12th year of operation. With its strong emphasis on the development of students who would not otherwise be in the upper levels of the biomedical career track, successful applicants to the program are required to demonstrate high motivation to pursue doctoral study, but lacking in the requisite skill sets to be considered for admission into a competitive doctoral program in the biomedical sciences. Once admitted, MU PREP Scholars participate in a program regimen that addresses weaknesses in preparation, usually through enrollment in first year graduate course(s) and participation in a meaningful research experience. MU PREP Scholars also participate in a weekly course designed to enhance professional communication skills as well as targeted preparation for the graduate school application process. While the program is designed to be successfully completed in one year, it is not uncommon for MU PREP Scholars to appeal for a second year of study.

In 2009, the MU PREP program leaders decided, as part of the application renewal process, to implement a more intense mentoring approach. The rationale for this shift was twofold: 1) while cultural sensitivity and solid support structures are critical components of the program, the leaders of the program were also sensitive to the unintended consequence of dependence on such supports by trainees; 2) professional success at the doctoral level is often predicted by "degree quality" as is often measured by levels of productivity, quality of networking circles, and training pedigree. As such, the program was modified to have an intense mentoring structure that prioritized rigor in training and an emphasis on developing cultural capital and identity as a successful scientist. During their first year, MU PREP Scholars receive very critical real-time feedback on their performance in venues such as journal clubs and snap research presentations within PREP group meetings. This critical feedback extends to regular individual meetings with a research mentoring committee and program leaders where all aspects of their performance in the program are discussed. Program expectations are mapped to Scholar performance with an emphasis on the development and performance consistent with maturity in scientific thought, behavior and performance. MU PREP Scholars expressed being overwhelmed in the first year, but scholars were in agreement with research mentors and program leaders that by the second year they had gained experience and confidence.

MU PREP Scholars reported in evaluation interviews and focus groups about being pushed almost to their limit in the journal club, and often being recipients of "tough love" in one-on-one and committee meetings. In hindsight (during the second year), they see how much those experiences challenged them and encouraged personal and professional growth. They came across as seasoned and much more senior when observed alongside second-year graduate students in joint focus group interviews. The shift in mentoring strategy was also evident in the program outcomes. Prior to the change in mentoring model, MU PREP Scholars were successful in making the transition to doctoral programs (93%), but were often placed in programs at mid-tier institutions. After the shift in mentoring approach, MU PREP Scholars are more typically placed in higher-tier institutions (Hopkins, UPENN, UNC Chapel Hill, U, of Michigan etc.) to the extent that MU has considerable more difficulty retaining its own PREP Scholars in MU graduate programs. For MU PREP Scholars who completed the PhD, time to degree averaged 5.9 years with 3.4 average numbers of publications (median 2, high 11).

Transformational Impact of IMSD on Institutional Models for Recruitment and Graduate Training.
Nicquet M.J. Blake—Univeristy of Texas Health Science Center and Anthony L. DePass—Long Island University

University of Texas Health Science Center at San Antonio (UTHSC-SA) is one of the country's leading health sciences universities with its ranking in the top 3 % of all institutions worldwide receiving NIH funding. Located in the city with the largest Hispanic population (807,000) that comprises 60% of its residents, UTHSCSA faced significant challenges in the diversification of its student population in its Graduate School of Biomedical Sciences (GSBS) where six years ago, only 12% were from underrepresented (UR) groups in STEM. Additionally, the program faced attrition of 40% of UR students who left the program in the first year, primarily for academic reasons. Of the remaining 60% that persisted, time to degree was delayed about a year compared with non- URM peers.

A series of interventions were employed to address these issues. Interventions included a strategic change in recruitment, the development of three pre-matriculation courses, individualized mentoring, tutoring and remediation programs (if needed), boot camp and community/cohort building interactions. Mentoring played a pivotal role in the development of these students. Starting with peer mentors upon acceptance of the offer, 2 faculty mentors from the admission committee, the IMSD program director students are very carefully mentoring throughout their graduate careers.

In the first year of the new recruitment plan, 8 of the 42 matriculating students (19%) were URM, up from 12% in the previous year. By 2011, the first year of the NIH funded IMSD program, the percentage of UR students applying to the integrated graduate program had increased with 42% of matriculated students coming from UR groups. Undergraduate grade point average (GPA) of matriculating UR students has improved steadily over the duration of the grant registering 3.52 in 2014 (up from 3.05). Of the 22 scholars who have been appointed to the IMSD grant, 50% completed the mandatory, 8 credit hour first year core course with a **grade of "A".** None required remediation of the first year core course. The first IMSD student defended his dissertation in April 2015 with a time to degree of under 4 years.

The interventions that guided the dramatic improvements in the recruitment, retention and persistence of IMSD scholars have now been adopted institutional wide by the graduate school at UTHSC-SA. The Boot Camp activity that was piloted in the IMSD program has been adopted as part of the IMGP program and is now slated to be incorporated as standard across the graduate school. The UTHSC-SA IMSD program continues to have a significant institutional impact with the recent reorganization of the graduate school curriculum that will incorporate many of the practices that first saw success in the UTHSC-SA IMSD program.

S07: Barriers and Solutions to Advancing Careers

Chair: John Matsui

Perceived Academic Career Coach Effectiveness by Coaching Style among Biomedical PhD Students
Veronica Y. Womack, Simon N. Williams, Bhoomi K. Thakore, Letitia A. Onyango, and Richard McGee—all of Northwestern University

For the past several years, we have been experimenting with the use of coaching as a supplement to traditional research mentoring. Unlike a mentor, our coaches are not affiliated with the student's home institution and, consequently, can provide independent and unbiased advice. Students also

have access to the knowledge and support of their peers who belong to their coaching group (10 students at a similar stage of training). This coaching model has been in existence for four years, and we now have enough data to identify, assess and compare them in association with the students' perception of coach effectiveness. The objective of this study is to 1) qualitatively determine the coaching styles and categorize the coaches by coaching style, and 2) use data from student interviews to identify perceptions of coach effectiveness by coaching style.

One hundred US biomedical graduate students were randomly assigned to one of ten coaching groups a month before beginning graduate school. Each coaching group had an equal number of men, women, underrepresented minorities (URM) and non-URM students. A senior faculty coach in the biomedical sciences led each group. The coaching groups met in person annually for 3 years. Students were encouraged to maintain virtual communication with both their coaching group and their coach throughout the year. The coaches were interviewed after in-person meetings and 6 months later. Students were interviewed the summer after their first and second years of graduate school. The interviews after the 2nd year of are the focus of the current analysis.

A researcher read the coach interviews and extracted details related to "strategies to engage", "perceptions of individual students", "perceptions of student engagement", and "self-assessment". A profile for each coach and their coaching style was constructed based on the profile content. One key theme that emerged was their degree of proactivity with engaging individuals coaching groups. This aspect of his or her coaching style categorized each coach. Previously coded student interviews were analyzed with particular attention to those within "Relationship with Coach". A summary of the students' evaluation of their coach was created. From this nine measures of coach effectiveness emerged. This study will focus on coach effectiveness as measured by "usefulness".

Of nine coaches interviewed at all time points, their proactivity with respect to engaging individual students was classified as high (n=4), moderate (n=2) or low (n=3). Coaches were categorized with respect to proactivity with engaging their groups as high (n=6) or low (n=3).

Across coach styles and student responses, coaches were perceived as useful, especially when they provided encouragement and detailed feedback on research proposals. The later was seen most frequently with female URM students. Students with a high proactivity coach (for individual or group) talked more to their coach about stressful situations than those with low proactivity coaches. Students with low proactivity coaches stated that they wanted to have more interaction with their coach and coaching group.

This study found that perceived coach usefulness for 2nd year biomedical graduate students varies by degree of coach proactivity. Future analyses will assess the thematic variations of "coach usefulness" and "coaching group usefulness" by student URM status, gender, and year of training.

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Benefits of the Academy Coaching Intervention on Perceptions of Academic Career Success

Bhoomi K. Thakore, Veronica Y. Womack, Simon N. Williams, Letitia Onyango, and Richard McGee—all of Northwestern University

Recent studies have acknowledged the many difficulties with acquiring an academic STEM career in the current economic climate. This reality exacerbates the relatively unchanged recruitment and retention of women and underrepresented minorities (URMs) into STEM faculty, despite many targeted efforts. On an individual level, intention to persist in an academic career can be informed by a number of factors. First, an individual's personal motivation to pursue an academic career ("Wanting") can vary and shift during one's academic training. Second, the dynamics associated with acquiring ("Getting") an academic position are palpable in this current

professional climate. Third, one's ability to succeed in an academic position upon acquiring one ("Succeeding") is related to the degree to which one's confidence increases or remains high over time.

The Academy for Future Science Faculty (henceforth, the Academy) is a longitudinal intervention created to address the issues associated with achieving diversity among faculty in the biomedical sciences. The first wave of the Academy began with 100 beginning PhD students representing a range of biomedical sciences departments and disciplines and an equal number of controls. Those who applied were randomly assigned to Academy or control, and the Academy group was equally stratified by race and gender. The objectives of the Academy intervention are two-fold: 1) delivery of information to promote graduate student success through annual in-person meetings held between 2011 and 2013, and 2) sustained development of communities through the random placement of 10 students into Coaching Groups each headed by an Academic Career Coach (henceforth, Coach). We identified Coaches as senior scientists in the biomedical sciences who are committed to faculty diversity efforts. Both objectives of the intervention are guided by key social science theories that help explain issues of inequality in biomedical training and career placement.

In this presentation, we will use a mixed-methods approach. First, we will examine longitudinal quantitative reports of students' perceptions of "confidence in succeeding in an academic career" after 2 and 3 years of Academy participation. After this analysis, we will use longitudinal qualitative interview data to understand those Academy students who sustain and/or increase in their perception of "Succeeding" as a result of the Academy.

Preliminary findings suggest that there are no significant differences in "Succeeding" between the Academy and Control groups, nor are there differences between URMs and non-URMs in the Academy group. However, there are significant differences between men and women in the Academy group. Specifically, men in the Academy had a similar decline in "Succeeding" to those in the control, while women in the Academy held constant. Subsequent analysis will also examine other variables, such as the relationship between "Succeeding" for those Academy students who share the same gender as their Coach.

This research was supported by DP4 GM096807 (ARRA) and R01 GM107701.

Latina STEM Pathways to the Professoriate: Findings from President's Postdoctoral Fellowship Program Interview Study

Yvette Flores, Lisceth Brazil-Cruz, Marilou de Leon Siantz, Adela de la Torre, and Laura Grindstaff—all of University of California, Davis

Several barriers deter Latina PhDs from entering into STEM careers in academia. Few qualitative studies have documented the career paths of Latinas in STEM fields to understand the contextual factors leading them to choose other career pathways outside of the professoriate. This interdisciplinary team of researchers has set out to investigate the career paths of former Latina UC President Postdoctoral fellows [PPFP] in various STEM disciplines between 1998 and 2014 by conducting in-depth, semi-structured interviews. The interviews are designed to identify the social, familial, and institutional barriers PPFP scholars have faced, their experiences of gender, class, and ethnic/racial discrimination, and the impact of the fellowship on their career success. This presentation will focus on the factors Latina PPFP fellows experienced throughout their educational trajectories that have lead them to successfully enter academia.

S08: Social Psychological Factors in Student Performance

Chair: Mona Trempe

Diversifying Science: Programs Weaken the Effect of Chronic Stereotype Threat on Maladaptive Achievement Goals

Anna Woodcock, Paul R. Hernandez, and P. Wesley Schultz—all of California State University

The importance of diversifying the U.S. scientific research workforce is widely acknowledged, yet African Americans and Hispanic/Latino(a)s continue to be chronically underrepresented in research careers, and face many barriers to pursuing these fields (National Institutes of Health, 2012; National Science Foundation, 2010). One well-recognized barrier is the prevalence of negative racial stereotypes about aptitude for science-related endeavors. Negative stereotypes about one's group are a source of identity threat and have well-documented detrimental effects on performance across many stereotyped domains (e.g., Steele & Aronson, 1995; Steele, Spencer, & Aronson, 2002). The experience of persistent occurrences of stereotype threat across time predicts underrepresented minorities' disidentification with, and attrition from the sciences (Woodcock, Hernandez, Estrada, & Schultz, 2012).

We argue that disparities such as ethnic/racial underrepresentation in the scientific workforce are one consequence of contending with persistent stereotype threat across time – what we refer to as chronic stereotype threat. Achievement goals such as mastery (a focus on developing personal competence and attaining mastery of material), performance-avoidance (avoiding the appearance of incompetence, especially in the presence of others), and performance-approach (a focus on demonstrating competence, especially in the presence of others) goals are critical to how students frame and cope with academic challenges The goals the students adopt give purpose and direction to academic achievement-related behaviors and are predictive of academic performance, field choice, and persistence (Harackiewicz, Barron, Tauer, & Elliot, 2002). The long-term impact of chronic stereotype threat on academic achievement goals has not been previously studied. Understanding how achievement goals mediate the effects of stereotype threat across time may be crucial for addressing issues of disparity. We examine the impact of chronic stereotype threat on underrepresented minorities' (URMs) academic achievement goals and persistence in science across time in the context of a well-established intervention and training program – the NIH's Research Initiative for Scientific Enhancement (RISE) program.

Previous research has shown that the long-standing NIH RISE training program is effective at retaining underrepresented minorities in science. We argue that one of the mechanisms for this success is the reduction in maladaptive achievement goals that can be brought on by stereotype threat. We report analyses of a national sample comparing RISE students with propensity-score matched controls over a six year period. Mediation analyses revealed that while RISE program membership did not buffer students from stereotype threat, it changed students' downstream responses and ultimately their academic outcomes. Non-program students were less likely than RISE students to persist in the sciences, partially because they adopted maladaptive achievement goals in response to chronic stereotype threat. We discuss how these findings extend stereotype threat and goal orientation theories and provide insight into the success of intervention programs.

In this scholarly work, we make a case for the importance of learning from successful people on an individual basis. In particular, we present case studies of Latinas who, on a daily basis, struggle to maintain a sense of balance between their professional aspirations in the STEM fields, and the multiple socio-political contexts within which their lives are enacted. We refer to this infinite set of contexts as contextual mitigating factors (CMFs) which are dynamic, and interweave community, education, family, and gender/self, to name a few. The preparation and development of these contexts create circumstances, which overlap and aggregate in time to change moment-by-moment. These contextual fluxes serve as mitigating forces that help to shape the multilayered outcomes of resiliencies and related positionalities for these women. Embracing and overcoming, or at least stabilizing, the mitigating factors are key factors inherent to the success of each of the Latinas in this story. These Latinas, because of their gender, ethnicity, and/or race, are models of resilience to sociocultural contextual mitigating factors. We do not use the word resilience in a neoliberal sense, i.e., those who tough it out can make it. Rather we think of resilience as a signature that indicates the existence of societal inequities that particularly target people because of who they are.

The case studies presented within are individual stories with general patterns. Some Latin@ readers may argue that there is no difference between their stories and those in our narrative. Other non-Latin@s may claim the same, and point to not only their stories, but also to those of a handful of others. We stridently reject either argument because to accept these notions would counter the realities that Latinas must negotiate in the United States. In other words, even though a few Latinas have been successful in their endeavors, this is no cause for a celebration; gender related inequity and social injustice still exist. In terms of inequity and social injustice, the question of success should be situated with an interrogation of the notion of societal impact of such a nature that stories of resilience disappear. For example, within the US society, the underrepresentation and disenfranchisement of Latinas in the educational pipeline (Flores & Claeys, 2011), and specifically in STEM persist (National Science Foundation [NSF], 2013; Santiago, 2008). While there has been an increase in success among Latinas, their level of accomplishment in a male-dominated world should not be romanticized; rather, given the odds of overcoming the many obstacles faced along the academic and professional paths, Latinas' successes must be highlighted. Kao (2007) argues that the lack of nurturing the potential of a large underrepresented group, such as Latinas, is the "wicket problem of education." (p. 101). While revolutionary Latinas have flexed their muscles and have stood at the crossroads of entering into the STEM fields, in spite of their successes, that world is still dominated by their male counterparts, especially White men (NSF, 2013). Latinas also must contend with other mitigating factors, such as a worldview that is not inclusive of all.

Unfortunately, the literature abounds with examples of either treating individuals from a holistic point of view, or specifically in the case of Latin@s, denying their rich but very distinct sociocultural, economic, political, and historical roots by simply considering them as a homogenous group (Flores, Sheets, & Clark, 2011; Gallard, 2009). We assert that how individuals identify themselves as racial, ethnic and/or cultural beings is paramount to understanding how they respond to how they are situated or positioned in education via a host of dynamic socio-political CMFs.

Note: We use Latin@ to reject the gendering of the category Latino/a and thus making it gender neutral.

Cooperative Online Learning Tools for Middle School Science: Lessons Learned from a Design-based Research Study

Fatima E. Terrazas-Arellanes, Emily Walden, Lisa A. Strycker, and Carolyn Knox—all of University of Oregon

This symposium reports lessons learned on the NSF-funded Collaborative Online Projects for English Language Learners (COPELLS) project, in which an iterative process of development, implementation, revision, and evaluation was used to design and test collaborative online learning science curricula for middle school students, including general education students and English learners (primarily of Hispanic origin). Using a design-based research approach, two case studies and a feasibility study, with a total of 212 students and 10 teachers, were undertaken to determine the potential for adapting two online science units, originally developed in Spanish by curriculum developers in Mexico, for U.S. middle school English learners. We examined whether the refined "Let's Help Our Environment" and "What Your Body Needs" units were feasible to implement, useful for helping teachers engage with students, and effective in improving science knowledge. Data were drawn from multiple sources, including teacher logs, student and teacher surveys, web analytics, student notebooks, content assessments, and focus groups. Results indicate that the online science units were feasible to implement, usable and helpful for both teachers and students, and associated with gains in science content knowledge. This work offers a model for the development of culturally-relevant, constructivist, and collaborative science instructional materials for English learners using online, multimedia technology.

S09: Institutional Case Studies

Chair: Claudia Rankins

Inclusive Chemistry Success Project

Rebecca Ciancanelli and Julia Willis—both of Colorado University Boulder

The Department of Chemistry and the Student Academic Success Center (SASC) at CU Boulder completed the Fall 2014 Inclusive Chemistry Success Project that coordinates pre-assessment, advising, core instruction, supplementary instruction, and post-assessment. The primary goal was to improve first-term outcomes for a freshman cohort of 20-25 underrepresented and underserved students based in SASC who plan to enroll in a general chemistry course in order to complete a MAPS requirement or to prepare for a STEM major.

SASC combines an historical commitment to social justice with an inclusive model of academic excellence that has always been, and will always be, centered on the student. We define ourselves as a multicultural learning community that serves underrepresented, underserved, first-generation, low-income, and other non-traditional students. We deliver instruction, scholarships, advising, tutoring, resources, and community to improve the recruitment, retention, persistence, and graduation rate of students who contribute to the cultural diversity and academic excellence of the CU Boulder campus.

To begin the Inclusive Chemistry Success Project, we administered the ALEKS chemistry exam as a placement tool during the summer of 2014. Students who scored below a 50% on the exam were encouraged to enroll in the SASC section of introductory chemistry, CHEM 1021. Our SASC instructor, Dr. Rebecca Ciancanelli, collaborated with the chemistry department CHEM 1021 instructor, Dr. Robert Parson, to align the pace of curriculum and assessments. The SASC instructor added two POGIL (Process Oriented Guided Inquiry-based Learning) sessions during the week; POGIL is an active learning model of chemistry instruction that has been shown to improve process skills and content knowledge.

Of the 22 students who enrolled in the SASC section of CHEM 1021, 19 students completed

the course. We have compared exam grades and course grades of this cohort with the SASC students enrolled in university's CHEM 1021 course in Spring 2014. Both the spring and fall cohorts took three midterms and a final written by Dr. Robert Parson. The fall SASC cohort showed great improvement over the spring SASC cohort on exams and course grades.

We also have examined some preliminary qualitative data provided by the CLASS (Colorado Learning Attitudes about Science Survey). This survey was administered twice, at the beginning and at the end of the semester. The data suggest improvement in students' overall understanding of how to learn and apply chemistry knowledge. For example, there was significant improvement in attitude from pre- to post-testing on these statements:

1. Learning chemistry changes my ideas about how the world works.
2. When I see a chemical formula, I try to picture how the atoms are arranged and connected.
3. To understand chemistry, I discuss it with friends and other students.

We have enrolled 24 students in CHEM 1113 (General Chemistry) this semester, and we are following the same project design. We will continue to collect data and eventually analyze the results of the SASC students participating in the Inclusive Chemistry Success Project with both the five-year average for SASC student performance and the five-year average for the general population performance in these chemistry courses. We hope to expand this project to other gateway courses in the sciences, including General Biology I and General Physics I.

Factors that Predict Interest in Pursuing Research Careers among URM Students

Erin Banks, Amy Leonard, and Craig Brookins—all of North Carolina State University

The Initiative for Maximizing Student Diversity (IMSD) program at North Carolina State University utilizes a multi-tiered approach to increase the number of underrepresented minority (URM) students who attain bachelors and doctorate degrees and engage in research in the biomedical and behavioral sciences (BBS). Although the structure of IMSD and other NIH Funded programs vary by university, all have a component of social support that appears to be critical in students'' success. Social integration and support found in faculty members and peers has been found critical for student retention (Astin, 1993; Bean, 1980, Tinto, 1993). Foertsch, Alexander & Penberthy (2000) report increased academic achievement, educational aspirations, self-concept and persistence among Latina/os and African Americans when involved in research and mentorship with faculty.

This presentation will focus on the role of non-academic and academic support has on students participating in a federal funded research programs across the southeast. The goal of the session is to discuss preliminary findings on the role of social support and its impact on the retention and academic success of URM students majoring in the BBS fields. This session should benefit upper level undergraduate students, graduate students, administrators, faculty members, and others engaged in the implementation of enhancement programs on campus.

Common Denominators for Successful STEM Graduate School Preparation in the School of Engineering (SoE) and the School of Computer, Mathematics and Natural Sciences (SCMNS) at Morgan State University (MSU).

Christine F. Hohmann, Jumoke Ladeji-Osias, Michel Reece, Cleo Hughes-Darden, Lisa Brown and Stella Hargett—Morgan State University

In the past decade, MSU has been the Baccalaureate granting institution for 45 individuals who received doctorates in Engineering and 61 individuals who received Ph.D. degrees in the Life Sciences and other STEM disciplines (WebCASPAR). This ranks MSU 9th in the nation and 2nd among public institutions in preparing undergraduate students for successful Ph.D. completion. This is

particularly remarkable, as the mission of MSU is to provide educational opportunities to students from urban and near-urban public school systems, a population who are frequently first generation college students and over 60% Pell-grant eligible. Several undergraduate training practices in the School of Engineering (SoE) and the School of Computer, Mathematics and Natural Sciences (SCMNS) have emerged as major contributors to our outcomes.

Structured, summer and academic year research, mentored predominantly by MSU faculty, builds communities of practice among undergraduates, faculty and graduate students. Undergraduate participants in these activities are supported financially at a level equal to or better then off campus employment would afford them. This is essential, since students depend on such income to support their education. More then 85% of students in the MBRS RISE program (SCMNS) agree or highly agree that year round mentored research experience has increased their critical thinking skills, their self-confidence, leadership ability and networking skills. In a long-standing summer research program in Engineering (SEM), students pointed out their "enjoyment of working with mentors", "exploring the field" and "doing something worthwhile". Between SEM and MBRS RISE, paid research apprenticeships of >300 undergraduates have been supported and both show student graduation and retention rates in the major, which far exceed respective departmental averages in either School. The MBRS RISE Program has to date graduated 98 % of all participants, most in their original major, > 90 of graduates are currently engaged in a science related occupation, 85% pursued post-graduate education (MS or similar) in a science related discipline, 20% entered Ph.D. Programs and 10% have obtained their Ph.D. to date. MBRS RISE student performance outpaces those of any program in the SoE, most likely, because MBRS RISE also offers a rich, year-round menu of supplemental academic, skill building (critical thinking, scientific writing, soft skills) and research career-focused activities, all aimed towards enhancement of community, science identity and self-efficacy. For example, 100% of students rated attendance of the Annual ABRCMS conference as "extremely or very helpful" in building their presentation, communication, networking and independent research skills. Several of annual workshop activities, as well as the Critical Analysis of the Scientific Literature class were rated similarly high for "cultural adaptability training for graduate school" and providing "increased critical thinking skills". In the SoE, on the other hand, a training component that contributes substantially to the development of science identity among participants is the PACE (Pre-freshman Accelerated Curriculum in Engineering), which incorporates group learning, to facilitate student engagement in undergraduate research.

This symposium will provide detailed descriptions of the various training components that our program evaluations have earmarked as particularly effective in student retention, graduation and importantly, progression into graduate training. We will discuss these interventions within the sociological framework that renders them effective, particularly within the epistemological environment of the SCMNS and the SoE.

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S10: Career Preparation: Research and Practice

Chair: Laura Robles

Addressing the Intersectionality of Underrepresentation and STEM Identity through Holistic Professional Development for Graduate Students and Postdocs

Renetta Garrison Tull, Shawnisha Hester, Amanda Lo, Piyush Waradpande, and Yara Medina—all of University of Maryland Baltimore County (UMBC)

PROMISE: Maryland's Alliance for Graduate Education and the Professoriate (AGEP), sponsored by the National Science Foundation, is examining research in intersectionality to inform the structure of interventions that influence underrepresented minority (URM) STEM graduate students and postdoctoral fellows' retention in STEM training programs and pursuit of STEM careers. Intersectionality, originally defined by Kimberle' Crenshaw (1989) and further popularized by Patricia Hill Collins (1998), has been used as a lens to view intersecting oppressions such as those within and between race, class and gender. Our work looks at the intersection of underrepresentation in STEM, and STEM identity. URM STEM students can manifest feelings of inadequacy, struggles with departure from community and culture, and (e.g., Tinto, 1993; Giuffrida, 2006), and we're interested in investigating how disconnections from community, and internal and external lack of acceptance as "a scientist" might impact persistence. As we examine research and seek to impact practice, we learn from Carlone and Johnson's (2007) "Theory of Science Identity" which describes three dimensions: competence, performance and recognition. The PROMISE AGEP seeks to improve underrepresented minority (URM) STEM performance, by providing academic professional development to solidify competencies, using workshop-based interventions such as "Writing for Publication" and "Improving Public Speaking." In an effort to build a comprehensive program that engages URMs in STEM, we've also included the "integration and fulfillment of needs" element from McMillan & Chavis' 1986 theory of Psychological Sense of Community within professional development activities to provide concepts that are transferrable to daily life. This presentation focuses on three areas of "holistic" professional development that have had traction with URMs in STEM at the University of Maryland Baltimore County (UMBC): psychological well-being, financial Literacy, and career-life balance. We believe that the integration of holistic and academic forms of professional development build connections among URMs that encourage competencies within the discipline, and contribute to STEM identity.

UMBC's psychological well-being workshops address anxieties, and identify cognitive distortions such as catastrophizing. Financially-based seminars include investing and planning for retirement. Career-life balance sessions discuss managing family and life responsibilities, and health and wellness. Data trends from the workshops show that students agree that they are presented with tools and new knowledge, e.g., controlling apathy, credit scores, and structures for career-life integration. The workshops provide information that is not typically accessed by students of color. (As an example, URMs score the lowest on financial literacy tests, with failure percentages above 80% (Mandell, 2008).) However, our data show that URMs note that these workshops provide new information, contribute to their sense of community, connect them to others with similar ideas, and contribute to degree completion. We believe that these elements connect with the "recognition" dimension of "The Theory of Science Identity" and that URMs' regular and repeated participation in professional development (both academic and holistic) can increase depth of engagement in research, lead to higher levels of STEM competence and performance, and contribute to their STEM identity.

The Evolution of Career Intentions of Biomedical PhD Students: A Longitudinal Qualitative Study of a Diverse Population

Christine Wood, Remi Jones, and Robin Remich—all of Northwestern University

Much has been written about the declining interest in biomedical academic careers as students progress through the PhD. This decline contributes to the extremely low rate of progress toward achieving faculty diversity. However, very little is known about the experiences that shape career interests and the process by which students refine future plans. In this presentation, we introduce our research that explores how biomedical PhD students make decisions about what careers to pursue as they progress through the first two years of graduate school. After a brief overview of the methods we used to longitudinally analyze career intentions and decision-making, we present preliminary findings focusing on factors that influence students' intentions toward and away from academic careers. We distinguish perceptions of three different types of academic careers: research-intensive, teaching-intensive and research/teaching mixed. We frame our findings using four patterns of student interest in academic careers, students with (1) consistently high academic career intention; (2) increase in academic career intention; (3) decrease in academic career intention; and (4) fluctuating academic career intention. We will share demographics for each pattern as they compare with our full sample revealing which patterns are more heavily populated by students under-represented in biomedical faculty positions, e.g., females, non-Whites, and non-Asians.

Our data come from in-depth interviews with 198 PhD students in the biomedical sciences conducted annually for 3-5 years, beginning with the start of each student's PhD career. Our population is diverse in terms of gender, race, and ethnicity. About two-thirds (63%) are female. Twenty-nine percent are considered under-represented racially and ethnically in the sciences (non-White and non-Asian). Specifically, 15% identified as Black or African American, 11% as Hispanic, and 2% as Native American. This research is part of the National Longitudinal Study of Young Life Scientists (NYSYLS), a longitudinal study begun in 2008 to better understand the experiences of a diverse population of students during biomedical PhD training.

For this analysis, we used longitudinal qualitative methods to compile, display, and analyze in-depth interviews conducted over time. For our analysis, we focused on data collected at interviews from questions targeted at career intentions, such as (1) "As of today, what do you want to do when you finish your PhD?" (2) "What attracts you to the particular option or options you are considering?" (3) "Right now, what priorities are most important to you as you decide among career options?" (4) "How do you envision balancing a career with other things in your life, in say 10-15 years?" For this study the team developed a coding rubric to assess strength of career intention for the three different types of academic careers, as well as assessing interest in trajectories towards industry, government, and careers outside of research.

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Toward a Career-Specific Developmental Model for African Americans in STEM

LaVar J. Charleston and Jerlando F. L. Jackson—both of University of Wisconsin-Madison

This study sought to ascertain key factors that contribute to African Americans' STEM pursuits. The design of this study varied from previous research by examining the career trajectories of current STEM professionals, particularly in the field of computing sciences, rather than those who did not persist, or those in the beginning stages of the pipeline. As such, this study allowed the researchers to implicate a heuristic model that serves to help illuminate as well as facilitate decision-making toward educational and occupational considerations in STEM fields in general and the computing sciences in particular.

S11: National Networks with a Disciplinary Focus

Chair: Alberto Roca

Erasing the Achievement Gap in Graduate Education for Underrepresented students: Bridge Programs run by Professional Societies

Theodore Hodapp and Brian Beckford—American Physical Society

In nearly every science, math, and engineering field there is a significant falloff in participation by underrepresented minority (URM) students who fail to make the transition between undergraduate and graduate studies. The American Physical Society (APS) has realized that a professional society can erase this gap by acting as a national recruiter of URM physics students and connecting these individuals with graduate programs that are eager to a) attract motivated students to their program, b) increase domestic student participation, and c) improve the diversity of their program. In only two years the APS has placed enough students into graduate programs nationwide to effectively eliminate this achievement gap. The program has low costs, is well received among graduate programs, and has encouraged a number of universities to adopt best practices that improve their graduate admissions and retention. The structure is disciplinary specific, but can be adapted to other fields of study. This presentation will describe programmatic elements and present data that demonstrate the project's effectiveness.

Re-assessing What Works-A Novel Approach to Measuring Efficacy and Early Findings from a Broad Intervention Partnership

Mark A. Lawson, Anna Woodcock, Anthony M. Johnson, P. Wesley Schultz, Richard McGee, and Steven M. Anderson—all of University of California, San Diego

A common theme of intervention programs that target the transition of underrepresented minority (URM) students from undergraduate to graduate study is to provide a training experience that exposes the participants to biomedical research and familiarizes them with the laboratory and scientific environment. It is expected that familiarizing students with practice of science encourages them to pursue biomedical research as a career, and evaluation of intervention programs is based on measurement of this particular outcome. Based on these assumptions, the Endocrine Society has developed a mentoring and intervention program MAP that partners minority-serving institutions with research-oriented institutions and a professional society to provide extensive mentoring and research training to prepare students for progression to post-baccalaureate and graduate study. This network leverages its community to improve training, mentorship, and career development. Based on a two-year model, Endocrine Society members recruit students from minority-serving institutions to participate in two summer research experiences. Participants attend the society annual meeting where they are introduced to peers and mentors, attend career development sessions, and are guided through the general meeting. Afterwards participants join a summer program at a partner research institution. In the second year participants again attend the meeting to present their previous summer's work. They also act as peer mentors to new participants. In addition, trainees are encouraged to attend recruiting conferences such as SACNAS and ABRCMS, and are mentored through the graduate program application process.

The effectiveness of MAP is measured and evaluated using a novel dual quantitative and qualitative approach. The evaluation is designed to assess program outcomes and to uncover underlying mechanisms contributing to student success. The qualitative approach provides rich feedback from the students for program best practice and improvement via structured interviews

and ethnographic data. The quantitative approach complements the qualitative evaluation with quantitative data. This research/evaluation approach features a longitudinal matched-control design to evaluate both the short and long-term impact of the program. Central to the evaluation, MAP students are matched with a group of non-MAP URM students who are equally talented and interested in a scientific research career and measured across time. Across three years we find significant differences in the scientific career interest trajectories of MAP and matched non-MAP students. The non-MAP students show a significant decline in intention to pursue a scientific research career across their undergraduate years. However, MAP students are buffered from this decline and retain high intentions of persisting on the scientific research career path.

This design allows us to answer questions about why programs like MAP are effective. Drawn from social psychological literature, we hypothesize that programs that are designed to develop lab skills and scientific self-efficacy, also have positive effects on students' scientific identity, opportunities to fulfill communal (helping) goals, and resilience to stereotype threat. We find that these psychological outcomes are more powerful predictors of URM persistence in science than scientific skill and self-efficacy, and this is critical for the way we design and implement programs.

Defining the Quantitative and Computational Skills of Incoming Biology Students

Paul J. Overvoorde and Q6 Consortium—both of Macalester College

A number of recent national reports such as Vision and Change, Preparing Future Physicians, and BIO2010 make the case that a student's quantitative and computational preparation correlates with persistence and success in the life sciences. Unfortunately, among the students who take the ACT entrance exam, only 43 percent achieve a score that indicates that they have a 50 percent changes of earning a grade of B or higher in their first college-level math class. More disconcerting is that only 17% of high school students with an expressed interest in a STEM is considered math proficient by these standards. A further complication comes from the challenge of getting students to transfer their understanding of mathematical concepts to other discipline-specific contexts. With funding from the Howard Hughes Medical Institute, faculty from Macalester College, Bryn Mawr College, Oberlin College, Lewis and Clark College, St. Olaf College, Harvey Mudd College, Pomona College, and Keck Science Center, along with faculty and graduate students in the Educational Psychology department at the University of Minnesota formed the Q6 consortium. The goal of the Q6 group is to develop an assessment instrument that describes the quantitative and computational skills of students completing degrees in biology or closely allied fields. Starting from the knowledge domains and learning objectives described in several key reports, over the past two-and-a-half years we have developed, piloted, and refined a 22-item instrument called the Biology Science Quantitative Reasoning Exam (Biosquare). The development of this instrument and the psychometric characteristics of the items will be described. We envision the Biosquare serving at least three purposes. First, for students, the BioSQuaRE will communicate expectations for success in upper level courses and serve as a tool to direct students to relevant resources if they lack background or knowledge of a particular topic. For faculty, the BioSQuaRE will provide data on what students know, as well as when and how they gained that knowledge, allowing faculty to make intervention decisions based on evidence, rather than anecdote. Finally, at the programmatic level, the BioSQuaRE will highlight the skills biology instructors consider to be important, providing a framework to inventory and assess current curricula. Such an inventory could stimulate divisional conversations about the attention given to quantitative topics and the way these are framed by different departments. In the end, each level of consideration intends to supports student learning and persistence.

S12: Strategies with Undergraduates II

Chair: Richard McGee

How to Integrate Sustainability Concerns into Retention Strategies of Minority Engineering Students through Experiential Learning Interventions

Imelda Olague-Caballero and Delia Valles-Rosales—both of New Mexico State University

Global and cultural competencies of minority students could be incorporated to the engineering curriculum through experiential learning interventions. Experiential learning has been used as a retention strategy of minority students based on its capacity to foster skills and abilities more effectively learned outside a formal curriculum, specifically in real world scenarios. To understand the implications that experiential learning has on the professional performance of minority engineering graduates, the present study examined a program that has been in place since fall 2012. This program was framed on an industry-university partnership that promotes the integration of students' technical knowledge with and understanding of engineering practice in different real working environments. The proposed educational model used to ensure the development of the students_ ability to value diversity and to work effectively across cultures, while learning and practicing fundamental concepts of industrial engineering such us lean manufacturing, time studies, line balancing, quality control, and safety engineering in a real world scenario. The model was framed in the sophomore and senior curriculum series of IE 316 Methods Engineering & IE 478 Facilities Planning. The model consists of five components: identification and selection of industry partners and potential projects; attendance to in-class mini-lectures & assignment of pertinent readings supporting the selected project; student's training previous to their incorporation to the project; monitoring students_ progress by supervision of peer & industry mentors and class instructor; continuous evaluation and assessment of the learning experience through weekly reports and a final project presentation to the company's CEO. Completing the educational cycle, cultural competencies were developed throughout the model components by exposing the students to interactions with industry personnel at several levels including staff engineers, technicians, and blue-collar operators with different cultural and ethnical backgrounds. Partial results indicated that the design, structure, and application of the program and its success depend on the implementation of quality assurance techniques, permanent monitoring of students, and constant communication with the industry partner. Current concerns include how to ensure the long-term sustainability of the program. Proposed sustainability strategies include: Identify long-term benefits to flow from project; identify stakeholders for long-term benefits and determine level of support; identify and emphasize benefits that the industry partner; assess institutional support of the program through open ended questions evaluated through a multivariate technique called Structural Equations Modeling (allows for the study of complex relationships among variables and for inclusion of latent variables – not directly observable or measurable It is expected that this strategies will set the foundations of continuous improvement process that may help to secure the sustainability of the program.

Interventions That Work (and Some That Do Not)

Keith H. Pannell and Denise Carrejo—both of University of Texas at El Paso

For 30 years, using funding from the NIH MARC Program, we have mentored and guided undergraduate students through the last two years of their degree programs into Ph.D. programs and subsequent careers. To date a large majority of the UG participants have been successful in this transition and have obtained (are obtaining) Ph.D. degrees. Many of the graduates hold faculty positions. The positive outcome of this program is primarily associated with an intensive UG research training program, and for example, each student must write and orally defend a research

thesis prior to graduation.

Concurrently for the past 5 years, using funding from the NSF S-STEM program we have embarked upon a scholarship program to facilitate the navigation of the first two years of college by our incoming freshman students. This was a time period we identified as crucial for retention in, and graduation from, a STEM degree program. A mandatory aspect of the scholarship award was on-campus living, an unusual feature at an Urban University, where the students can live only minutes away from the campus. This programmatic requirement has proven to be key to the overall success of the program, along with allocation of an individual faculty tutor. Also in our environment, which contains a large Hispanic population, the ability of the student to be home with family for portions of the weekend has been a major feature in obtaining parental approval of the program, since often the scholarship awarded covers only the cost of housing, i.e. financially it is a sum zero activity.

For both the NIH and NSF programs, a important aspect in keeping a cohort cohesiveness, and providing a depth of engagement amongst the students, is an annual research, science ethics course combining both students groups.

The outcomes of the two programs, and the various interventions used, will be presented in quantitative terms (credit hours taken, GPA achieved, time to graduation (including comparisons where available with peer cohorts not in such programs, and Ph.D. and published research papers produced). Overall a major key to this success is program flexibility and the capacity to change proposed activities to suit the needs of the students, and the local environment. Unsuccessful interventions, mentors and activities must be readily jettisoned, and their fruitful counterparts expanded.

Disciplinary First-Year Seminar Tackles the Achievement Gap

Caroline Jakuba Wienhold, Tawnya L. Cary and Janet L. Branchaw—all of WISCIENCE University of Wisconsin-Madison

As part of a HHMI Undergraduate Science Education award, we developed a series of interventions to address an achievement gap and the subsequent loss of underrepresented minority (URM) and first-generation college students (FGEN) from biology at UW-Madison. Overall, these populations of students earn lower grades in introductory biology courses at UW-Madison than majority students, and, even when earning passing grades, leave the biosciences at a higher rate. Though there are many programs for underrepresented student populations on our campus that support retention in general, there is a gap in support for student success and retention in biology specifically.

Evidence from the literature shows that having a sense of community increases student retention and success in college. Therefore, our aim was to develop interventions designed to create discipline-based learning communities to impact biology students specifically. Interventions included a 3-day freshman orientation (MadBiology Boot Camp), a learning center (BioCommons), a residential learning community (BioHouse) and a first-year seminar (Exploring Biology). The Exploring Biology first-year seminar (FYS) will be described and its outcomes to date presented.

Topical, disciplinary or remedial themed FYS introduce students to campus resources, support student acclimation to college, study skills development, and individual self-exploration. Tinto's theory of social and academic integration proposes that the level of integration achieved by a student in the first year dictates the likelihood that she/he will be retained and ultimately complete a degree. Tinto argues students achieve integration through their own motivation and, importantly, through support from the university in five broad categories including: academic involvement and support, early contact and community building, transition assistance, counseling and advising, monitoring and early warning.

Combining the disciplinary theme of a FYS with Tinto's theory, we hypothesized that providing transitional support in a discipline-based format would lead to improved retention and

success for URM and FGEN students in biology. Exploring Biology supports students' academic, social and developmental needs as they transition to college and engages them in the exploration of biology as a discipline and potential career path. The course goals are to help students develop disciplinary ways of thinking, develop awareness of and access to biology co-curricular learning opportunities, and explore and prepare for careers in biology.

Outcomes from 6 semesters of Exploring Biology were measured using student record data, a pre/post survey, focus groups and an alumni survey. There was a significant reduction in adverse outcomes (D, F or drop grades, p).

S13: Student Pipelines and Teacher Training

Chair: LaVar Charleston

Blended Learning Strategies in Teaching Mixed Method Research to School Teachers

Echo H. Wu and Samir Patel—both of Murray State University

Completing research methodology courses is now a requirement for student-teachers at graduate level in universities. However, students at both undergraduate and graduate levels often possess weak knowledge and skills in conducting empirical research (Aguado, 2009). It is commonly believed that conducting research is a tedious and very tiring and time-consuming work to do, and student teachers attending university courses, including master's degree courses, usually do not feel competent in conducting research, despite receiving training in research methodology (Bocar, 2013). Typically, students learn about quantitative and qualitative research separately and within a traditional teaching and learning framework (Onwuegbuzie & Leech, 2005). In Hong Kong, specifically, conducting empirical research is difficult for in-service student teachers, specifically, preschool and kindergarten teachers, who are often very busy in teaching and taking care of young students, who may also have less training and are lack of skills and knowledge regarding research methods (Wu, 2008).

Blended learning has been a popular topic in education. It is believed that blended learning is the combination of different training "media", including technologies, activities and events, to create an optimum training program for a specific audience (Bershin, 2004). Such programs use many different forms of e-learning, sometimes complemented with instructor-led training and other learning formats. Recent research has reports high student satisfaction with blended learning (Albrecht, 2006), and some others also reported instructor satisfaction (Vaughan & Garrison, 2006). This is consistent with the result of a study conducted by Bourne and Seaman (2005), who indicated that the interest in blended learning is to benefit the education process.

This presentation focuses on the pedagogical strategies of blended learning to teach schoolteachers how to conduct mixed method research. Through a case study at Hong Kong with in-service preschool teachers, this presentation discusses the implications of blending traditional teaching and more updated learning strategies such as e-Learning, small group work, peer interaction, and role plays, so to make the commonly-viewed by school teachers as complicated and even intimidating empirical research more comprehensible and achievable.

The Institute On Neuroscience (ION) Summer Research Program for Outstanding High School Students and Teachers

Chris Goode and Kyle Frantz—both of Georgia State University

To recruit bright students into the scientific research community, we have designed and implemented an eight-week summer research program for high school students, and recently included middle and high school teachers. Program participants engage in authentic neuroscience research in working laboratories or clinics in the metro-Atlanta area (Georgia State University,

Emory University, Georgia Institute of Technology, Morehouse College, or Spelman College). Since 2003, a diverse group of 110 scholars have participated in this program, called the Institute on Neuroscience (ION). Seventy-six percent of the participants were women, and 33% were from racial or ethnic groups currently under-represented in the sciences. We have used a variety of mixed-method, quantitative and qualitative approaches to examine program outcomes over the years. For example, we have tested the hypothesis that a summer research experience positively affects intent to persist in a science or research career, via improvements in scientific research self-efficacy, science teaching self-efficacy, neuroscience content knowledge, science identity, and science and research anxiety. Here, we report the results of pre-, mid- and post-program surveys of two cohorts of 12 participants each. Participants reported improved confidence with neuroscience concepts, scientific research self-efficacy, science identity, and intent to persist in a science career, as well as decreased research anxiety. Teachers reported increased science teaching self-efficacy. Regression models revealed that confidence with neuroscience concepts predicted intent to persist in a research career, and science identity and neuroscience anxiety predicted intent to persist in science. Thus, initial short-term benefits of a summer research immersion predict long-term benefits, such as retention in pathways toward research careers for students, and improvement of science teaching, which may in turn lead to improved science learning for students not directly involved in the program. Ultimately this program and its education research results contribute to preparation and diversity of the biomedical research workforce.

The Loma Linda University Health Disparities Research Pipeline Program: Best Practices, Outcomes and Institutional Impact

Marino De Leon, Carlos A Casino, Lorena Salto, and Daisy D. De Leon—All of The Loma Linda University Health

It has become increasingly important to establish comprehensive STEM (science, technology, engineering, and mathematics) pipeline programs that will help achieve the necessary inclusion and diversity goals in the next generation of U.S. scientists. The Loma Linda University Health Disparities Research pipeline program (LLU-HDRPP) has demonstrated significant success in recruiting and preparing more than 400 predominantly underrepresented minority (URM) students for matriculation into STEM and behavioral science graduate programs nationwide. This presentation will first describe the initial hypothesis that led us to build a comprehensive pipeline program that relies heavily on hands-on health disparities research experiences, mentorship, institutional support and community collaborations. As we detail the implementation of our pipeline program, which is already in its 17th year- we will show a best practice as well as a mixed-methods approach to evaluate our outcomes. We will also present evidence on the importance of an early high school intervention to increase URM student persistence in STEM disciplines. The LLU-HDRPP immerses high school (ABC), undergraduate (UTP), medical (MTP) and PhD graduate students (IMSD) in an 8-10 week summer research and career development internship. Our quantitative data consistently shows that the program impacts students by increasing their research self-efficacy and targeted research skills. The largest gains reported by the participants were for "conducting research," "scientific writing," and research self-efficacy. For the high school participants, the results indicate that the research internship mainly targeted the research capability and the STEM confidence of these participants. Further analysis shows the importance of the hands-on research experience (enactive mastery experiences), the mentor experience (vicarious experiences/modeling) and other factors that play important roles. The LLU-HDRPP outcomes show that 94% of the high school students obtain a college degree and 63% of those in a STEM/behavioral science degree discipline. The data also shows that 98% of the UTP students graduate from college; 94% of them with a STEM/behavioral science degree. More than 98% of IMSD graduate students are completing their PhD degree and pursuing further postdoctoral career

development. The MTP students are incorporating research in their residency programs and establishing practices in medically underserved communities. Interestingly, 52% of the high school and 81% of the undergraduate students matriculate into graduate programs. Of those who have participated in our programs, 176 have enrolled in a graduate program and 121 of those have enrolled in Loma Linda University for their graduate education.

This project was supported in part by NIH grants R25GM060507 and P20MD00698.

S14: First Generation Graduation Students

Chair: Barry Komisaruk

Can Interventions Change the Decline in First Generation Doctorate Recipients in STEM?

Anne J. MacLachlan—University of California

STEM doctoral education is subject to contentious discussion about how it is funded, career possibilities and training and whether there are too few or too many scientists trained. Receiving much less attention is the increasingly elite background of doctorate recipients, 78% in 2013 come from educated and highly educated backgrounds (SED, 2014). First generation students (parents with a high school diploma or less) of all ethnicities have lost substantial access to and completion of programs since 1978 when such students received 42% of doctorates (SED 2009). Members of US ethnic minorities may or may not be first generation and/or low income in 2015, but the percentage receiving doctorates in STEM is barely increasing.

There is no argument that first generation, low income children and adolescents and those belonging to other underrepresented groups are usually best served by a continuum of interventions from Headstart onwards. These and subsequent programs promote entry into the language of science and analysis, and higher level vocabulary and grammar in case it not spoken at home. However, a great many social, economic and personal circumstances can lead to participants not persisting, or not acquiring the full measure of knowledge available.

For students in these groups who successfully complete a bachelor's degree in STEM and enter a doctoral program the question addressed in this paper is whether interventions at the doctoral level can improve their success rate. It is too often inferred that the national Ph.D. dropout rate of around 50% comes from this population, but there is not enough data to support this inference (CGS). At the same time there is sufficient evidence that specific interventions at the doctoral level do promote student success. Whatever a student's background, admission to a STEM doctoral program requires successfully completing a relevant undergraduate curriculum. Barring inappropriate admission practices, students arrive with some preparation and the desire for a degree.

This paper reviews the kinds of interventions found in STEM doctoral training, the research literature on them and where they may fall short. To a limited extent it looks at the research on what students think about their training including my Spencer funded study on STEM Ph.D. recipients from the University of California. The paper is a consolidated review examining programs like AGEP, and LS-AMP which are part of a continuum, to those created often in isolation by disciplinary societies, individual universities/departments/faculty. The emphasis is on programs that address issues of first generation students. It builds on a catalog of programs I have developed over the years, focusing on shared characteristics and areas of intervention along with whether there are credible measures of success. It also provides a limited amount of student evaluation taken from my survey and others.

'First-Generation' Graduate Students and Postdocs: Yes, They Exist and You Should Pay Attention!

Carrie Cameron, Hwa Young Lee, Shine Chang, Cheryl Anderson, and Melinda Yates—all of The University of Texas MD Anderson Cancer Center

Students who are in the first generation of their family to attend college (1G) have begun to receive increasing attention regarding unique challenges they may face in the undergraduate academic environment, including questioning of their belonging and academic identity, financial stressors, and family tensions resulting from their departure for college (Jehangir, 2009; Metheny & McWhirter, 2013).However, very little attention has been paid to these students when they reach the graduate and postdoctoral level. In fact, a lack of supportive policies and interventions for 1G students that pursue graduate degrees, suggests that students who have made their way into the graduate level have 'made it' and no longer encounter these stressors. Is this actually the case? Through focus groups, interviews, and surveys, at a major academic health center in Texas, we sought to find out more about the graduate and postdoctoral experience of 1G trainees, including what stressors they identify, their perceptions of their relationships with mentors, and their perceptions of their communication skills (frequently considered a manifestation of socioeconomic, racial, and ethnic identity). We also sought to tease apart the influences of family economic status during the trainee's childhood, race, ethnicity, and native language from 1G status. Our qualitative date suggest that 1G trainees feel that personal financial stressors during school and training are an extraordinarily important problem in educational and career development decisions and that the challenges of 'fitting in' increase rather than decrease at the graduate level. The quantitative results of our survey (N=218, all US citizens or permanent residents) indicate, among other things, that 1G trainees are older (mean1G=34.91, meanCEF=29.49).

Plenary Abstracts

Plenary I: Scientific Workforce Diversity: Opportunity for Enhancing Research Excellence

Hannah Valantine, MD—National Institutes of Health

Diversity is known to benefit learning, teamwork, and productivity, yet large sectors of the U.S. population are not members of the biomedical research engine of innovation. Dr. Hannah Valantine, recently appointed the NIH Chief Officer for Scientific Workforce Diversity, will describe NIH's research-based, integrated set of approaches and programs that address diversity as a scientific issue ripe for exploration and new opportunity.

Plenary II: Are We Measuring and Interpreting What We Value about Programs?

Clifton Poodry—Howard Hughes Medical Institute; Kelly Mack—Project Kaleidoscope; Daryl E. Chubin—Independent Consultant; Anthony L. DePass—Long Island University-Brooklyn

Regardless of the interventions utilized, success for many programs designed to broaden participation in science and research related careers often is judged by progress toward the outcomes mandated by the funder of the program. For several programs, the ultimate goal has been the increase in diversity of those in the PhD ranks that has been translated to be the number underrepresented students entering doctoral programs by the end of the program's funding period. This principal metric has, especially in the past, been the measure upon which grant reviewers and programs have relied on to determine the effectiveness of a program. With the obvious pressure for funding renewal, some PIs have employed extreme tactics that include undergraduate students signing contracts under the threat of repayment of program support if the student decides not to pursue doctoral study.

The utilization of this primary metric has also led many to question the efficacy of many programs as the number of PhDs from underrepresented groups in many science disciplines remains low. This plenary session will explore measures that would appear to counter some of the current efficacy interpretations. It will shed light on progress toward increasing diversity in the scientific workforce that might have been missed. In sum: Are we asking the right questions? Are we misinterpreting the reality of our programs based on the data we choose to acknowledge? Would different metrics better reflect what we value while serving both programs and their students?

Plenary III: Student Transitions from 2- to 4-Year Institutions

Moderator: Anthony L. DePass

Shifting Students' Stereotypes of Scientists to Enhance Science Identity in a Diverse, Community College Context

Jeff Schinske, Amanda Snyder, Heather Perkins, Mary Wyner, Monica Cardenas, Jahana Kaliangara—all of De Anza College

Bandura's (1977) social learning theory suggests that seeing role models with characteristics similar to oneself succeed at a task increases one's own self efficacy in regards to that task. Further, gender/ethnic-matching may be particularly important in the establishment of effective role models (Haas, 1985). The relative lack of prominent gender/ethnic-matched role models for many traditionally underserved STEM students may therefore present a disadvantage to such students in connecting with STEM and building a science identity. Indeed, numerous studies have uncovered connections between a sense of belonging in science, scientist stereotypes, science identity, and students' persistence/success in STEM. We tested a series of weekly metacognitive homework assignments ("Scientist Spotlights") to introduce students to diverse scientist role models in a non-majors/general education biology class at a diverse community college. We matched scientists' work to the schedule of course content and attended to numerous axes of diversity in selecting scientists to highlight, including ethnicity, gender identity, socioeconomic status, age, academic history, interests outside science, neurotype, etc. Students learned about the scientists through podcasts, TED Talks, and academic articles, among other resources, and were instructed to reflect on what they learned by recording their interests/confusions surrounding the scientist's work, generating questions about the biology content discussed, and reporting what the assignment told them about the types of people that do science. Based on previous studies we hypothesized:

1) Students would initially hold stereotypical images of scientists and would initially report a lack of personal connections with scientists.
2) After completing Scientist Spotlights, students would hold more non-stereotypical images of scientists.
3) After completing Scientist Spotlights, students would feel they could personally relate to at least one scientist.
4) Students would tend to cite gender/ethnic-matched scientists as those to whom they could most closely relate.
5) Self-reported ability to relate to a scientist would correlate with achievement in class.

We evaluated these hypotheses by analyzing beginning-of-class and end-of-class student surveys. Surveys consisted of a constructed-response assessment regarding scientist stereotypes and a Likert assessment with constructed-response explanation regarding ability to relate to scientists. Assessments were piloted and validity was examined in a prior class that did not include Scientist Spotlights. Results provided evidence in support of Hypotheses 1, 2, 3, and 5. While some students wrote about the importance to them of hearing from gender or ethnic-matched scientists, there was over-all a poor correlation between students' genders/ethnicities and those of scientists to whom they said they could relate. As Scientist Spotlights require virtually no class time and can be

graded simply for completion, this intervention provides an effective way for all educators to enhance science identity and shift stereotypes in a broad range of STEM classrooms while complementing existing curricula and lessons.

Hostos Community College-The City University of New York Joint Dual Engineering Degree Program: A Successful Marriage

Yoel Rodríguez; Felix Cardona—both of Hostos Community College and Anthony L. DePass—Long Island University—Brooklyn

Hostos Community College (HCC), located in the South Bronx, is one of seven community colleges in The City University System of New York (CUNY). With classes offered in English and Spanish, HCC serves a student population that is over three quarters Hispanic (For spring 2014 the students profile was Hispanic 59.5%, Black 22.1%, White 2.1%, Asian 3.4%), reflecting a local community of Puerto Ricans and new immigrants from the Dominican Republic and Central America. In 2003, HCC established its first Joint Dual (JD) Admission Engineering Degree A.S./B.E. Program in *Electrical Engineering* with the Grove School of Engineering (GsoE) of CUNY's flagship senior college, The City College of New York (CCNY). The program has since been expanded to A.S./B.E. in *Civil Engineering* (2005), A.S./B.E. in *Chemical Engineering* (2007), A.S./B.E. in *Mechanical Engineering* (2011), and A.S/B.E. in *Environmental Engineering*, approved in spring 2014. Students in the JD program complete freshman and sophomore courses at HCC, reflecting the engineering curricula at the senior college with opportunities for any necessary remediation. A number of key interventions are also employed to promote retention and enhance academic performance for students that would not have been directly admitted into the CCNY engineering programs. These interventions include: 1) an intense advisement schedule that begins with 'Engineering Orientation Day' activities where the students are informed about the program expectations, the requirements necessary to remain in the program, and the admission criteria to transfer to CCNY's GsoE after successful completion of the A.S. in Engineering at HCC; 2) an Advisement Council comprised of 17 faculty from the Mathematics and Natural Sciences departments; 3) 'Celebration of the Conversation Days' where juniors and seniors in engineering and engineering alumni share their journey to earning their engineering degree and how they navigate(d) academic and life challenges; 4) *STEM Institutes* that enhance preparation for gatekeeper courses; 5) career oriented-STEM seminars where engineers and scientists present their research and talk about their careers; 6) 'Transfer Orientation Day" at CCNY's GsoE, where the students who are about to take ePermit classes as well as transferring are informed about senior college life and expectations; 7) STEM related field trips to national laboratories and research intensive universities, science museum visits, and 'Math and Physics Days' that engage the local community. Students in the program are also encouraged to leverage other CUNY programs that promote undergraduate research training.

As of fall 2014, 109 students (13 percent female) have graduated from HCC with A.S. in Engineering degrees. Ninety-two students have transferred to CCNY's GsoE, some of whom transferred before the A.S. degree. Thirty-five students from the program transferred to CCNY but switched to other majors or discontinued. Based on a five-year enrollment period (fall 2007/spring 2012), about 41% of HCC students who have transferred to CCNY's GSOE have graduated with the B.E., with an additional 14 percent

matriculated in CCNY's GsoE. When more recent data is considered, the senior college retention rate is 66% (this is for the period covering fall 2007/spring 2012) and retention within major is currently 83% for the fall 2014 compared to 17% for spring 2010. Three of program alumni are currently pursuing their PhD and MS degrees in Princeton, Pennsylvania and Stanford Universities.

Plenary IV: The Importance of Understanding Human Behavior: Stereotype Threat and Implicit Bias in the Academy and in Business

Lydia Villa-Komaroff—Cytonome/ST

While conscious biases and outright discrimination are still painfully present in our country, on the whole, our society agrees that discrimination does not serve the best interests of scholarship or business. Despite this general agreement and a great deal of well-intentioned activity in both the academic and corporate worlds, under-representation of women and people of color remains a vexing reality in both sectors. This is a complex and multifaceted problem. Factors in this very slow progress may include the failure to adequately incorporate current understanding of stereotype threat and implicit biases in the development of programs as well as resistance to the ideas that all humans harbor implicit biases and that stereotype threat can lead to underperformance in a variety of settings. In this plenary, the role that stereotype threat and implicit bias play in underrepresentation in STEM in academia and business, as well as strategies that help to compensate for these deeply ingrained aspects of human behavior will be discussed. A substantial portion of the session will be devoted to audience discussion. and questions.

UNDERSTANDING INTERVENTIONS

2015 CONFERENCE PROGRAM ADDENDUM

H11: Connecting Students in the Mathematical Sciences to Information and Opportunities: The National Alliance Approach

Randi Congelton - University of Illinois at Urbana-Champaign

In 2012−2013, the U.S. awarded 1,843 doctoral degrees in mathematical science, with 46.5% awarded to U.S. citizens. Of domestic students, only 24 graduates were African American and only 25 were Latino (AMS, 2013). The National Alliance for Doctoral Studies in the Mathematical Sciences is a nation-wide program seeking to improve the recruitment and retention of talented, underrepresented domestic students in mathematics, statistics, and biostatistics. In particular, the Alliance works to increase the retention of women, racial and ethnic minorities, and those lacking access to high-level math courses through the completion of the doctorate. Students join through nomination by Alliance faculty members who serve as mentors for the program. Rather than being housed at a single or small set of institutions, the Alliance connects hundreds of students and faculty from different institutions, ranging from small baccalaureate-granting colleges to large research-intensive universities.

The unique structure of the Alliance directly impact students' educational trajectories through mentoring and other services, allowing it to transcend programmatic and institutional boundaries. Retention strategies used by the Alliance include exposing students to information and opportunities they might not otherwise have. This exposure occurs through both relationships with faculty mentors and an annual conference attended by Alliance students and mentors. Both mechanisms help students learn about opportunities in the mathematical sciences, including research experiences for undergraduate (REU) programs, graduate programs, the graduate application process, postdoctoral positions and experiences, funding opportunities, and other professional development opportunities. Although careers in academia are given preference, students also learn about industry and government careers.

To help investigate the impact of the Alliance, qualitative and quantitative data were gathered from Alliance students and mentors through surveys, focus groups, and interviews. Preliminary analyses of the data yields insight into the impact the Alliance has on students' experiences in the mathematical sciences via networking and exposure. Specifically, students served by the Alliance learn about research and career opportunities, network with peers, and connect with faculty and role models. One underrepresented female describing the Alliance as "an excellent networking opportunity…It kind of opened my eyes to all the career paths I can go in, in all different interests and areas I could go into". Another female student indicated that "because our school is kind of small, like our math department is kind of small, so being able to see that other people are doing the same think and having the same interest, it's real good…it's good to see other people with the same interest and then coming together and then discussing it".

The mentor network and annual convening conference could be replicated by other STEM fields to increase students' awareness of information and opportunities, which may not only positively affect their retention in such fields but also enhance their experiences and advancement in these fields. Session participants will learn of the Alliance's underlying logic model, be encouraged to think about the key

opportunities and critical pieces of information that students ideally should be exposed to, and ways to facilitate networking and information exchanges to support students.

H12: Developing a Successful Post-baccalaureate Program for Increasing the Number of Students from Underrepresented Groups Who Obtain STEM PhD Degrees: The UMass Experience

Sandra L Petersen - University of Massachusetts Amherst
Presented by Vanessa Hall – University of Massachusetts - Amherst

The participation of citizens from all segments of the U.S. population is critical for continued U.S. preeminence in science, technology, engineering and mathematics (STEM). To address this issue, we need new models for increasing the number of students from underrepresented groups who obtain doctoral degrees and join the STEM workforce. Underrepresented students who have completed baccalaureate degrees, but have not gone on to obtain advanced degrees, comprise a large untapped talent pool. During the past eight years, the University of Massachusetts Amherst (UMass Amherst) implemented, evaluated and revised a very effective postbaccalaureate research training program with funding from NSF (Northeast Alliance for Graduate Education and the Professoriate; NEAGEP) and NIH (UMass Postbaccalaureate Research Education Program; PREP). Several novel components contribute to the success of our program. First, participants in the NEAGEP (non-biomedical disciplines) or PREP (biomedical/biobehavioral disciplines) programs must participate in an 8-week summer program funded by UMass Amherst. Second, prospective students are matched to research-active faculty by faculty colleagues who serve as Core Faculty Coordinators in each discipline. Third, as part of the admissions process the prospective faculty member and student meet through Skype. These strategies facilitate early buy-in by the faculty. Fourth, the summer program focuses on research but also includes evening social and professional development activities with STEM graduate students and former NEAGEP or PREP interns. In addition, each NEAGEP or PREP intern is matched with at least one near-peer mentor and senior STEM Ph.D. students from underrepresented groups serve as dorm assistants for the summer. At the end of the summer, the student and faculty are better able to plan a year-long independent development program for the student. To facilitate the transition to graduate school, we also host a luncheon wherein the administrative assistants of participating graduate programs meet the NEAGEP or PREP interns. Finally, each intern takes two graduate level courses or relevant preparatory courses, and performs independent research during the year. Cluster and intrusive mentoring continues with the addition of a faculty mentoring committee for each intern. To date, all but two of the students who participated in the summer program decided to stay for the year. Moreover, 58 of 60 students who began PREP or NEAGEP internships completed the full year and 56 went on to graduate or professional programs. Many of the interns stay at UMass Amherst where admission committees are now willing to disregard GRE scores or previous imperfections in the records, because the faculty mentors have seen the interns perform well in classrooms and laboratories. An unforeseen benefit of the program is that by the time interns are accepted to the graduate program, they are a year ahead of peers who enter in the same cohort. Thus, they often become leaders in the program because they already “know the ropes”. Ten of our students recently obtained Ph.D. degrees in Chemistry, Kinesiology, Food Science, Molecular and Cell Biology or Microbiology at UMass. They are now in postdoctoral fellowships, industry or faculty positions, or serving as senior scientists in federal agencies. External evaluations of our programs show a high level of faculty support and student satisfaction.

H13: Effectively engaging and utilizing basic/biomedical science faculty members in diversity interventions

Sherilynn Black, PhD; Julie Reynolds, PhD; Kenneth Kreuzer, PhD- Duke University

Faculty engagement is a critical factor in the success of most student intervention programs. Increased faculty involvement typically leads to higher levels of student participation, additional levels of institutional support and overall culture change within scientific departments and programs. We have developed a series of faculty-based programmatic interventions through our Office of Biomedical Graduate Diversity (OBGD) and our Initiative for Maximizing Student Development (IMSD) program with the intention of improving mentor-mentee relationships, academic advising of diverse students and an increased overall investment in student training and professional development activities. These interventions have resulted in over 150 basic and biomedical science faculty members choosing to voluntarily affiliate with OBGD and our IMSD program and actively engage in working with underrepresented students. The increased levels of faculty engagement have also led to administrative support at the highest institutional levels for OBGD and IMSD diversity initiatives.

H14: Setting the STAGE (Smooth Transition for Advancement to Graduate Education) for Underrepresented Students in Mathematical Sciences: Lessons from this Pilot Project

Christina Eubanks-Turner, Patricia Bealieu, Nabendu Pal, and Aghalaya Vatsala- Loyola Marymount University

Smooth Transition for Advancement to Graduate Education (STAGE) for Underrepresented Students in Mathematical Sciences was a Pilot Project which was funded by the National Science Foundation for a three year period. The STAGE mentoring project had two main goals of giving participants a realistic graduate school environment which will enhance their ability to make a smooth transition from undergraduate to graduate studies and broaden students' vision about applications of mathematical sciences in other fields. In this talk we share perspectives, experiences and effective strategies of mentoring undergraduate students in research.

H15: To Grab and to Hold: Cultivating communal goals to overcome cultural and structural barrier in first-generation college students' science interest

Greg A Muragishi, Jill M. Allen, Dustin Thoman, Jessi Smith, Elizabeth R. Brown - California State University, Long Beach

Homogeneity within science limits creativity and discovery, and can feed into a perpetuating cycle of underrepresentation. Is there something within the traditional culture of science that limits, however unintentionally, underrepresented groups' participation in STEM? We examined whether the mismatch between the perceived uncommunal culture of science (little emphasis on collaboration, prosocial behavior, and relationships) and communal goals endorsed by underrepresented group members predicted immediate STEM interest and future career motivation. Focusing on first-generation students (FGS), we examine and identify factors that can be altered within the culture and structure of science education and training to catch (early STEM pipeline) and hold (late STEM pipeline) interest among this underrepresented group. Results demonstrate that distinct aspects of communal goal beliefs create barriers for FGS, but not continuing-generation students, in catching and holding STEM interest among undergraduate science researchers in both southern California and Montana. We recommend that scientific educators and institutions focus their efforts on interventions that influence and alter both the cultural and structural components of science by making more explicit communal links between research and application to increase FGS' perceptions of science fulfilling communal goals. Drawing on empirical evidence, we argue that as FGS perceive science as an opportunity to collaborate, help others, and establish relationships –communal goals will be fulfilled, and thus, barriers limiting FGS' participation in undergraduate and graduate STEM education and scientific careers will be reduced.

H16. Diversifying STEM: Attracting Person and Thing-Oriented People

Anna Woodcock—California State University San Marcos; William G. Graziano—Purdue University

Women and Hispanic/Latino(a)s, African Americans, and Native Americans are chronically underrepresented in STEM. To create a more balanced and competitive STEM workforce, we need to better understand the psychological factors that contribute to this. The extent to which people are interested in the people and things in their environment is strongly associated with academic and vocational choice (Graziano, Habashi, Evangelou, & Ngambeki, 2012; Su & Rounds, 2015). Consider your interest in the following: "Stopping to watch a machine working on the street" or "Making the first attempt to meet a new neighbor." Are you interested in one more than the other – or both? Vocational theories emphasize the importance of fit or congruence between an individual's interests and their physical environment. STEM disciplines are strongly stereotyped as "thing-oriented" endeavors however; women and underrepresented minorities tend to be higher in Person Orientation and lower in Thing Orientation. Recent research supports the notion of person and thing orientations as separate constructs – not opposing ends of a continuum – such that individuals can embody different Person and Thing Orientation configurations or specializations (Graziano et al., 2012; Little, 1968; Tay, Su, & Rounds, 2011; Woodcock, Graziano, Branch, Ngambeki, & Evangelou, 2013). Individuals who score high on Thing Orientation are classified as "thing specialists." Those who score high on Person Orientation are classified as "person specialists." Those who score high on both Person and Thing Orientations are classified as "generalists," and those low on both are classified as "non-specialists."

Individuals high on Thing Orientation (thing specialists) favor thing-oriented endeavors such as STEM. However, Person Orientation moderates the association between Thing Orientation and interest in STEM, whereby students high in Thing Orientation are less likely to major in STEM if they are also high in Person Orientation (generalists) (Woodcock et al., 2013). Generalists may be leaving STEM due to higher perceived fit in other academic domains, which has important implications for women and minorities in STEM.

We tested the hypothesis that manipulating situational cues of a STEM environment to be more person-oriented would increase interest from generalists (students high in both Person and Thing Orientations) without diminishing interest from students only scoring high in Thing Orientation. To test the impact of situational cues on perceived fit, we portrayed a fictitious STEM masters' program as either a "thing-oriented" or a "person-oriented" endeavor. The person-oriented portrayal increased feelings of belonging for generalists, and did not diminish feelings of belonging or perceptions of the program's difficulty and academic rigor for students with other person/thing orientation configurations. Implications for attracting and retaining a broad STEM talent pool are discussed.

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H17: Teaching Science Thinking through Writing and Literature Analysis

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Morgan State University (MSU) is a Historically Black University (HBCU) and an urban, public co-educational institution in the State of Maryland. Students at MSU are frequently 1st generation college students and over 60 % are Pell grant recipients. Nevertheless, MSU ranks among the top ten baccalaureate institutions (reporting period 2000-2011) for black Ph.Ds in the life sciences. Federally funded research training programs such as MBRS RISE, in existence at MSU since 1999 and MARC (intermittently since 1982), have played a major role in this success.

A need to improve students' writing skills in the sciences and the opportunity to use the analysis of the scientific literature as a vehicle to improve students' critical reasoning skills, did become apparent early on and was written into the 1st competitive MBRS RISE renewal application. In 2004 we established a training workshop for all RISE participants, which, by the interdisciplinary nature of the RISE participants (biology, chemistry, physical sciences, social behavioral sciences), also focused on interdisciplinary communication of students' research goals and their significance. This workshop morphed into a 2-semester course sequence and in 2012 became part the interdisciplinary course offering in the Department of Biology, listed as BIOL 450 (Critical Analysis of the Research Literature) and BIOL 451 (Senior Research Thesis).

BIOL 450/451 aims to affect students' science learning though exercises that foster cognition (learning strategies) and metacognition (understanding and monitoring one's cognitive processes) while building science identity and self-efficacy. Students engage in scientific text and data analyses, concept mapping, research (literature) presentations, focused discussions, peer review, etc. while developing their cap-stone writing assignments for each class.

This presentation focuses on the evaluation of these courses, within the context of a multi-institutional, collaborative NSF TUES grant, in partnership with Duke University, University of Minnesota, and University of North Carolina. The BIOL 451 capstone thesis paper, based on each student's own research project, is evaluated at Duke University using the BioTAP rubric (Reynolds, J. at al. 2009). BioTAP provides domain specific analysis of students' thesis writing and has allowed us to identify specific strength and weaknesses in our student's thinking and writing. An iterative approach from year 1 of the study (2013) to year 2 (2014) allowed us to implement targeted interventions to improve in areas of weakness and we are currently working on additional interventions for year 3 (2015). Our data suggest that emphasis on improving domain specific weaknesses from year 1 and to year 2 was effective and resulted in an overall improvement of the thesis BioTAP score for our students. Learning gains were also reflected in improved self-efficacy in a variety of science and writing related skills that were measured by pre-and post surveys conducted by our partners at Duke University. This also was reflected in student survey reports as part of the MBRS RISE Program evaluations at MSU. We conclude that using the BioTAP rating approach provides an effective means by which to assess and improve students' critical scientific thinking skills. Supported by: R25GM058904 and DUE-1225612.

H18: AGEP-T Frontiers of Research and Academic Models of Excellence (FRAME): Bridging Research and Practice to Promote Academic Engagement of Underrepresented Minorities in STEM Fields

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Despite growing recognition that advancement of innovations in STEM fields in the U.S. is often stymied by a lack of diversity among advanced STEM professionals, members of underrepresented groups continue to encounter considerable barriers to their success in STEM fields. In addition to barriers such as reduced access to resources and fewer opportunities for mentoring, research on social identity threat highlights the prevalence of messages in the academic environment that convey low value for underrepresented groups in STEM. To address these issues, we will describe a programmatic intervention (AGEP-T FRAME) that was designed to support the development of advanced URM STEM graduate students and postdoctoral trainees in the critical areas of research productivity, professional development, and postsecondary teaching. AGEP-T FRAME supplements doctoral training by focusing on the quality of degrees, and by providing professional preparation that will permit underrepresented minority graduate students and postdoctoral trainees in the STEM disciplines to compete and succeed in the Professoriate. Our recruitment, graduate and postdoctoral training components are designed to maximize professional outcomes in highly competitive research environments, with the aim of increasing URM representation in the Professoriate at all levels. To do this, Stony Brook University has formed an alliance with Brookhaven National Laboratory to provide comprehensive training for underrepresented postdoctoral fellows in key competencies that will enhance the trainee's likelihood of successful placement in faculty positions in research intensive institutions. Additionally, this strategic alliance provides academic integration for advanced underrepresented doctoral students in STEM to increase their research productivity by providing them with a series of opportunities to learn technical competencies, develop research collaborations, and broaden their scientific network. Combined, these activities support our goal to increase quantity and quality of research publications produced by AGEP-T students.
Finally, we will describe results of a longitudinal social science research study that builds on this programmatic intervention by examining whether one's academic environment provides a threatening context for URM students (vs. non-URM students) in STEM that undermines URM students' persistence in their STEM fields over time. Specifically, this study examines implicit theories of intelligence, confidence, and sense of belonging, to see if these psychosocial variables predict persistence in STEM fields over time. Supporting this possibility, preliminary results demonstrate that graduate students' beliefs that their STEM colleagues believe intelligence is a fixed (versus malleable) entity may create a context of threat – particularly for members of an underrepresented group in STEM (i.e. women), impacting confidence and sense of belonging among women and leading women to consider dropping out of their STEM career pathway. A description of the AGEP-T FRAME model as well as the rationale, methods, and results of the research study that builds on this model will be discussed.

H19. Outcomes from a pipeline program that increases research self-efficacy in high school and undergraduate underrepresented minority students

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There is a national need to develop and Implement pipeline programs that increase the number of URM students graduating with a STEM college degree to have a competent and diverse scientific workforce. Further, data is needed to determine what activities are critical to achieve this important objective. This report present findings from our over a decade long pipeline program at Loma Linda University School of Medicine. The program enrolls high school (HS) and undergraduate (UG) students to participate in an 8-10 weeks summer program that uses the "research-apprenticeship model". Our hypothesis is that exposing students to a successful hands-on biomedical research experience increases research self-efficacy augments their probability to enroll and graduate with college and postgraduate degrees in a

STEM discipline. The program has awarded 308 internships to 119 high school (HS) and 125 Undergraduate students (UG); 45 of which have participated more than once. Follow-up data for 102 HS participants show that 57% (54 of 94) are successfully progressing through college, 41% (39 of 94) have graduated from college and 71% (25 of 35) have graduated from college with a STEM degree. Out of 120 UG participants with follow-up data, 23% (28 of 120) are enrolled in college, 74% (89 of 120) have graduated and 90% (80 of 89) have been awarded a STEM degree. For HS college graduates with follow-up data, 66% (21 of 32) have enrolled in a post graduate degree; of those 75% (15 of 20) have pursued a biomedical research doctoral degree (MD, MD/PhD, PhD, DDS) and 20% (4 of 20) have pursued a Master's degree in a research discipline (MS, MPH). For UG college graduates with follow-up data, 76% (68 of 89) have enrolled in a Post-graduate degree; of those 75% (51 of 68) have pursued a biomedical research doctoral degree (MD, MD/PhD, PhD, DDS, DPT, PharmD) and 16% (11 of 68) have pursued a Master's degree in a research discipline (MS, MPH). We analyzed data from a cohort of ABC and UTP participants with self-assessed research skills and academic and research self-efficacy data from program surveys before and after the summer research experience. The HS (n= 34) and UG (n=32) participants perceived mean gains in "Scientific Writing," "Oral Presentations," "Library & Literature Search," "Conducting Research," and "General Academic" skills as a result of the research experience ($p< 0.05$ for all skills and for both ABC and UTP groups). The greatest mean gain reported for both groups was in "Conducting Research." Likewise, although both HS and UG groups perceived a small, but statistically significant mean gain in Academic Self-efficacy ($p< 0.05$), a greater mean gain was reported for Research Self-efficacy ($p< 0.001$) by each group at the end of the summer research experience. Based on paired-data from participant program applications, 25.5% of ABC participants and 51.9% of UTP participants indicated intent to incorporate research into their future career; out of those same participants, 89.4% of HS and 100% of UG participants indicated intent to incorporate research into their future career at the end of the summer research experience ($p< 0.001$). Further, HS and UG participants (n=64), the estimated odds of indicating "very likely" to pursue a biomedical research doctoral degree improved by about 25% for every 5 unit increase in research self-efficacy at the end of the summer research experience [OR 1.25 (95% CI 1.01-1.54), $p= 0.038$], but this association was not observed with academic self-efficacy. When asked about the most valuable/most beneficial aspect of the summer research program, 70% of HS and UG responses (n=84) attributed Mastery Experiences, due to hands-on research experiences, the culminating research symposium, and the overall learning experience, as the most beneficial aspect of the program, in accordance with Albert Bandura's Self-efficacy theory. We conclude that a hands-on summer experience focused in a research project increases URM research self-efficacy which results in URM commitment to STEM disciplines and success in biomedical research careers.