### Tuesday, July 30, 2019

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>1:00P – 7:00P</td>
<td>TWD2019PDM Management Desk Open/Registration Check-in</td>
<td>Grand Ballroom Foyer-</td>
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<tr>
<td></td>
<td></td>
<td>Alcove C</td>
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<tr>
<td>3:00P – 4:30P</td>
<td>Posters Installation</td>
<td>Grand Ballroom Foyer/</td>
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<td></td>
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<td>Salon A</td>
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<tr>
<td>4:55P – 5:00P</td>
<td>Welcome to TWD Innovations, Poster Highlights</td>
<td>Grand Ballroom Foyer</td>
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<tr>
<td></td>
<td>Speaker: Edgardo Falcón, Ph.D.</td>
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<tr>
<td>5:00P – 5:30P</td>
<td>Bethesda North Marriott-Sponsored Beverage Break</td>
<td>Grand Ballroom Foyer</td>
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<tr>
<td>5:00P – 7:00P</td>
<td>TWD Poster Session A &amp; Networking</td>
<td>Grand Ballroom Foyer/</td>
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<td>Salon A</td>
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<tr>
<td>7:00P – until</td>
<td>“DMV Dining” – Dinner on Your Own</td>
<td>Bethesda, Rockville, DMV</td>
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### Wednesday, July 31, 2019

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<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>6:00A – 8:00A</td>
<td>“DMV Dining” - Breakfast on Your Own</td>
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<td>7:30A – 6:00P</td>
<td>TWD2019PDM Management Desk Open/Registration Check-in</td>
<td>Grand Ballroom Foyer-</td>
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<td>Alcove C</td>
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<tr>
<td>8:00A – 9:30A</td>
<td>“Message from The Directors”</td>
<td>Salon D&amp;E</td>
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<tr>
<td></td>
<td>Speakers: Alison Gammie, Ph.D.; Jon Lorsch, Ph.D.</td>
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<tr>
<td>9:30A – 11:30A</td>
<td>Concurrent Session: Make Your Program Evaluation SMART by</td>
<td>Salon B&amp;C</td>
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<td></td>
<td>Aligning Objectives and Measures of Success</td>
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<td></td>
<td>Speaker: Nancy Moreno, Ph.D.; Moderator: Michael Sesma, Ph.D.</td>
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<tr>
<td>11:30A – 12:00P</td>
<td>Bethesda North Marriott-Sponsored Beverage Break</td>
<td>Grand Ballroom Foyer</td>
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<tr>
<td>11:30A – 1:00P</td>
<td>“DMV Dining” - Lunch on Your Own</td>
<td>Bethesda, Rockville, DMV</td>
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<tr>
<td>1:00P – 2:30P</td>
<td>Concurrent Panel: Employing Evidence-based Practices for Training,</td>
<td>Salon B&amp;C</td>
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<td>Mentoring and Disseminating Outcomes</td>
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<td></td>
<td>Speakers: Elizabeth Watkins, Ph.D., Erin Dolan, Ph.D., Christine</td>
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<td>Pfund, Ph.D.; Moderator: Kenneth Gibbs, Jr., Ph.D.</td>
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<td></td>
<td>Speakers: Giovanna Guerrero-Medina, Ph.D., Sarah Goodwin, Ph.D., Angela DePace, Ph.D.; Moderator: Mercedes Rubio, Ph.D.</td>
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<tr>
<td>3:45P – 4:15P</td>
<td>Bethesda North Marriott-Sponsored Beverage Break</td>
<td>Grand Ballroom Foyer</td>
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<tr>
<td>4:15P – 5:30P</td>
<td>Promise and Peril in Higher Education: Building an Equitable,</td>
<td>Salon D&amp;E</td>
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<td>Creative, Prosperous, and Sustainable Future through</td>
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<td>Socially-Directed Science and Technology</td>
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<td></td>
<td>Speaker: Christine Ortiz, Ph.D.; Moderator: Shiva Singh, Ph.D.</td>
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<tr>
<td>5:30P – 7:00P</td>
<td>TWD Poster Session B &amp; Networking</td>
<td>Grand Ballroom Foyer/</td>
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<td>Salon A</td>
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### TWD2019PDM Conference Agenda

**Thursday, August 1, 2019**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
<th>Location</th>
<th>Details</th>
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<tbody>
<tr>
<td>6:00A – 8:00A</td>
<td>“DMV Dining” - Breakfast on Your Own</td>
<td>Bethesda, Rockville, DMV</td>
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<tr>
<td>7:30A – 6:30P</td>
<td>TWD2019PDM Management Desk Open</td>
<td>Grand Ballroom Foyer- Alcove C</td>
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<tr>
<td>8:00A – 9:30A</td>
<td>TWDPDO: MARC U-STAR, Session Leaders: E. Gavosto, Ph.D., C. Atkins, Ph.D.</td>
<td>Salon F</td>
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<tr>
<td></td>
<td>TWDPDO: IMSD, Session Leaders: B. Komisaruk, Ph.D., R. Chalkley, D. Phil</td>
<td>Salon B</td>
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<td>TWDPDO: RISE, Session Leader: V. Potluri, Ph.D.</td>
<td>Salon C</td>
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<tr>
<td></td>
<td>TWDPDO: IPERT/MARC T36, Session Leader: C. Pribbenow, Ph.D.</td>
<td>Great Falls</td>
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<td>TWDPDO: T32, Session Leader: A. Berrebi, Ph.D.</td>
<td>Salon G&amp;H</td>
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<td>TWDPDO: Bridges BS &amp; PhD, Session Leader: E. Alexander, Ph.D.</td>
<td>Linden Oak</td>
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<td>TWDPDO: PREP, Session Leaders: J. Hall, Ph.D., J. Lloyd, Ph.D.</td>
<td>Oakley</td>
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<td>TWDPDO: IRACDA, Session Leader: D. Sept, Ph.D.</td>
<td>Timberlawn</td>
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<tr>
<td>9:30A – 9:45A</td>
<td>Bethesda North Marriott-Sponsored Beverage Break</td>
<td>Grand Ballroom Foyer</td>
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<tr>
<td>9:45A – 9:50A</td>
<td>Welcome Day 2 Speaker: Hannah Valantine, M.D., M.R.C.P.</td>
<td>Salon D&amp;E</td>
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<tr>
<td>9:50A – 11:00A</td>
<td>Panel: Emphasizing Diversity and Inclusion as Essential Aspects of Training Excellence Speakers: JoAnn Trejo, Ph.D., M.B.A., Carlos Crespo, Dr.P.H., M.S., FACS, Sherilynn Black, Ph.D.; Moderator: Hannah Valantine, M.D., M.R.C.P.</td>
<td>Salon D&amp;E</td>
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</tr>
<tr>
<td>11:00A – 12:00P</td>
<td>Concurrent Panel: Leading Institutional Change - Becoming Change Agents Speakers: Lourdes Echegoyen, Ph.D., Andrew Campbell, Ph.D., Joey Barnett, Ph.D.; Moderator: Luis Cubano, Ph.D.</td>
<td>Salon B&amp;C</td>
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<td></td>
<td>Concurrent Panel: Building a Strong Mentoring Environment Speakers: M. Graca H. Vicente, Ph.D., Rick McGee, Ph.D., Tiera S. Coston, J.D., Ph.D.; Moderator: Sailaja Koduri, Ph.D.</td>
<td>Salon G&amp;H</td>
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<tr>
<td>12:00P – 1:15P</td>
<td>“DMV Dining” - Lunch on Your Own</td>
<td>Bethesda, Rockville, DMV</td>
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<tr>
<td>1:15P – 2:15P</td>
<td>Concurrent Panel: Teaching Rigor, Transparency and Responsible Conduct of Research Speakers: Rajini Rao, Ph.D., Gabriela Chavira, Ph.D., Isabel Lauren Jackson, Ph.D.; Moderator: Dorit Zuk, Ph.D.</td>
<td>Salon B&amp;C</td>
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<tr>
<td>2:15P – 3:30P</td>
<td>Panel: Equitable, Inclusive and Safe Environments Speakers: Kim McCall, Ph.D., Jason Sheltzer, Ph.D., Carol B. Muller, Ph.D.; Moderator: Alison Gammie, Ph.D.</td>
<td>Salon D&amp;E</td>
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<tr>
<td>3:30P – 3:45P</td>
<td>Bethesda North Marriott-Sponsored Beverage Break</td>
<td>Grand Ballroom Foyer</td>
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<tr>
<td>3:45P – 4:45P</td>
<td>NIH Policy on Sexual Harassment Speaker: Carrie D. Wolinetz, Ph.D.; Moderator: Judith Greenberg, Ph.D.</td>
<td>Salon D&amp;E</td>
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</tr>
<tr>
<td>4:45P – 5:45P</td>
<td>Enhancing Laboratory Safety and the Principles of Safe Research Speaker: Craig Merlic, Ph.D.; Moderator: Jon Lorsch, Ph.D.</td>
<td>Salon D&amp;E</td>
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<tr>
<td>5:45P – 7:15P</td>
<td>TWD Poster Session C &amp; Networking</td>
<td>Grand Ballroom Foyer</td>
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<tr>
<td>7:15P – Until...</td>
<td>“DMV Dining” - Dinner on Your Own</td>
<td>Bethesda, Rockville, DMV</td>
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<td>Time</td>
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<tr>
<td>6:00A – 7:30A</td>
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<tr>
<td>7:00A – 1:00P</td>
<td>TWD Attendees Luggage Storage</td>
<td>Salon A</td>
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<tr>
<td>7:30A – 8:30A</td>
<td>TWD Program Directors’ Organization (TWDPDO) Meeting</td>
<td>Salon D&amp;E</td>
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<tr>
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<td>Speaker: Henry Wortis, M.D.</td>
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<tr>
<td>8:30A – 8:45A</td>
<td>Welcome Day 3 Speaker: Desirée Salazar, Ph.D.</td>
<td>Salon D&amp;E</td>
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<tr>
<td>8:45A – 9:00A</td>
<td>Bethesda North Marriott-Sponsored Beverage Break</td>
<td>Grand Ballroom Foyer</td>
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<tr>
<td>9:00A – 10:00A</td>
<td>Concurrent Panel: Preparing Trainees for a Broad Range of Careers</td>
<td>Salon D&amp;E</td>
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<td></td>
<td>Speakers: Cynthia Fuhrmann, Ph.D., Ann Stock, Ph.D., Robert Kelly, Ph.D., Moderator: Patrick Brown, Ph.D.</td>
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<td></td>
<td>Concurrent Session: Encouraging Partnerships to Advance Data Science Training</td>
<td>Salon B&amp;C</td>
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<td>Speaker: King Jordan, Ph.D.; Moderator: Veerasamy Ravichandran, Ph.D.</td>
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<tr>
<td>10:00A – 11:00A</td>
<td>Student Wellness and Resilience</td>
<td>Salon D&amp;E</td>
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<tr>
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<td>Speaker: Sharon Milgram, Ph.D.; Moderator: Michael Sesma, Ph.D.</td>
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<tr>
<td>11:00A – 11:30A</td>
<td>Current Topics from the Division of Biomedical Research Workforce</td>
<td>Salon D&amp;E</td>
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<td>Speaker: P. Kay Lund, Ph.D. Moderator: Alison Gammie, Ph.D.</td>
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<tr>
<td>11:30A – 12:30P</td>
<td>Open Mic: TWD Listens/Feedback Session (TWD Staff Panel)</td>
<td>Salon D&amp;E</td>
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<tr>
<td></td>
<td>Alison Gammie, Ph.D., Michael Sesma, Ph.D., Shiva Singh, Ph.D., Stephanie Constant, Ph.D.</td>
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<tr>
<td>12:30P – 12:45P</td>
<td>Meeting Recap and Adjourn Speaker: Alison Gammie, Ph.D.</td>
<td>Salon D&amp;E</td>
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<tr>
<td>12:45P – 1:00P</td>
<td>Program Staff Available</td>
<td>Salon B&amp;C</td>
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*2019 TWD Program Directors’ Meeting is funded in part by awards from the National Institute of General Medical Sciences of the National Institutes of Health. [T36GM008637 and U13GM133156]*
<table>
<thead>
<tr>
<th>Section</th>
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<tbody>
<tr>
<td>Program-At-A-Glance</td>
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<tr>
<td>Welcome Letter</td>
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<tr>
<td>2019 TWD Program Planning Committee</td>
<td>5</td>
</tr>
<tr>
<td>Hotel Floorplan</td>
<td>6</td>
</tr>
<tr>
<td>2019 TWD Sessions Room Chart</td>
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<tr>
<td>2019 TWD General Information</td>
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<tr>
<td>Poll Everywhere Instructions</td>
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<tr>
<td>2019 TWD Speaker Profiles</td>
<td>10</td>
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<tr>
<td>2019 TWD Poster Sessions Schedule</td>
<td>25</td>
</tr>
<tr>
<td>2019 TWD Abstracts: Poster Session A</td>
<td>26</td>
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<tr>
<td>2019 TWD Abstracts: Poster Session B</td>
<td>59</td>
</tr>
<tr>
<td>2019 TWD Abstracts: Poster Session C</td>
<td>104</td>
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<tr>
<td>Acknowledgments</td>
<td>130</td>
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</table>
Dear Colleagues,

On behalf of the National Institute of General Medical Sciences (NIGMS), and the FASEB Office of Sponsored Programs, Diversity and Grants Administration, we’d like to welcome you to the Training, Workforce Development and Diversity (TWD) Program Director’s Meeting. We’re very excited about this meeting, which brings together a community of NIGMS trainers and educators dedicated to developing a diverse pool of scientists who have the skills to successfully transition into careers in the biomedical research workforce.

The meeting is designed to provide members of the NIGMS training community with opportunities to:

- Network – establish new connections and strengthen existing relationships to enhance training, mentoring, diversity, and professional development
- Exchange information, ideas, and innovations – share outcomes, tools, strategies, and effective practices
- Communicate – share training challenges and opportunities, and learn about current NIH/NIGMS policies and priorities

We truly appreciate your commitment, expertise, dedication, and hard work. We look forward to seeing your presentations and talking to you over the course of the next few days.

Welcome and thanks again for your engagement.

Jacquelyn Roberts
Director
Federation of American Societies for Experimental Biology (FASEB)
Office of Sponsored Programs, Diversity and Grants Administration

Alison Gammie
Director
Division of Training, Workforce Development, and Diversity
National Institute of General Medical Sciences (NIGMS)

2019 TWD Program Planning Committee

Edgardo Falcón, PhD (National Institutes of Health, National Institute of General Medical Sciences)
Alison Gammie, PhD (National Institutes of Health, National Institute of General Medical Sciences)
Barry Komisaruk, PhD (Rutgers University)
Jacquelyn (Jacquie) Roberts (Federation of American Societies for Experimental Biology)
Eduardo Rosa-Molinar, PhD (The University of Kansas)
Desirée Salazar, PhD (National Institutes of Health, National Institute of General Medical Sciences)
Michael Sesma, PhD (National Institutes of Health, National Institute of General Medical Sciences)
Cordelia Smith (Federation of American Societies for Experimental Biology)
Henry H. Wortis, MD (Tufts University School of Medicine)

2019 TWD Program Directors’ Meeting Management

Jacquelyn Roberts (Federation of American Societies for Experimental Biology)
Cordelia Smith (Federation of American Societies for Experimental Biology)
Bethesda North Marriott Hotel & Conference Center
<table>
<thead>
<tr>
<th>Time</th>
<th>Salon D&amp;E</th>
<th>FR: 11:30a-12:30p</th>
<th>Open Mic: TWD Listens/Feedback Session</th>
<th>TH: 11:00a-12:00p</th>
<th>Building a Strong Mentoring Environment</th>
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<tbody>
<tr>
<td>WE: 8:00a-8:30a</td>
<td>Welcome Day 1</td>
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<tr>
<td>WE: 8:30a-9:30a</td>
<td>Message from The Director</td>
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<td>TH: 9:45a-9:50a</td>
<td>Welcome Day 2</td>
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<td>TH: 9:50a-11:00a</td>
<td>Emphasizing Diversity &amp; Inclusion as Essential Aspects of Training Excellence</td>
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<tr>
<td>TH: 2:15p-3:30p</td>
<td>Equitable, Inclusive and Safe Environments</td>
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<td>TWDPDO Meeting</td>
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<tr>
<td>FR: 8:30a-8:45a</td>
<td>Welcome Day 3</td>
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<td>FR: 9:00a-10:00a</td>
<td>Preparing Trainees for a Broad Range of Careers</td>
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<td>Student Wellness &amp; Resilience</td>
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<td>Current Topics from the Division of Biomedical Research Workforce</td>
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<td>WE: 9:30a-11:30a</td>
<td>Make Your Program Evaluation SMART by Aligning Objectives &amp; Measures of Success</td>
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<tr>
<td>WE: 3:30p-3:45p</td>
<td>Encouraging Partnerships to Advance Data Science Training</td>
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<td>Leading Institutional Change – Becoming Change Agents</td>
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<tr>
<td>TH: 1:15p-2:15p</td>
<td>Teaching Rigor, Transparency &amp; RCR</td>
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<tr>
<td>FR: 9:00a-10:00a</td>
<td>Implementing Curricular Changes</td>
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<tr>
<td>WE: 9:30a-11:30a</td>
<td>Better Outcomes &amp; Greater Efficiency: Evaluation and Assessment in T32 Programs</td>
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<tr>
<td>WE: 1:00p-2:30p</td>
<td>Focusing on Technical, Operational, &amp; Professional Skills Development</td>
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<tr>
<td>WE: 2:30p-3:45p</td>
<td>Implementing Curricular Changes</td>
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<tr>
<td>TH: 8:00a-9:30a</td>
<td>TWDPDO: T32</td>
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## General Information

### TWD 2019 Registration Desk Hours

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
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<tbody>
<tr>
<td>Tuesday</td>
<td>1:00P – 7:00P</td>
</tr>
<tr>
<td>Wednesday</td>
<td>7:30A – 6:00P</td>
</tr>
<tr>
<td>Thursday</td>
<td>7:30A – 6:30P</td>
</tr>
<tr>
<td>Friday</td>
<td>7:30A – 11:30A</td>
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Managers-on-Duty: Jacquie Roberts and Cordelia Smith

### Audio/Visual Support provided by:

Bethesda North Marriott Hotel & Conference Center

### Location: Bethesda North Marriott Hotel & Conference Center

### FASEB Emergency Contact Info

Jacquie Roberts – 240.281.8294 (text or call)

### Bethesda North Marriott Emergency Contact Info

Dial “0”, front desk; Dial “9-1-1” for urgent emergencies

### Hotel/Conference Center Parking

- Conference Center Day Guest, fee: $2.50 hourly, max of $30 daily
- Parking for Registered Guests, fee: $17 daily

### Internet Access

- **Guest rooms Wireless:**
  - Complimentary for Marriott Bonvoy™ members; TWD 2019 attendees can enroll in Marriott Bonvoy™ program at check-in/free-of-charge
  - High Speed: $12.95/day;
  - Enhanced High Speed: $15.95/day

- **Lobby and public areas:** Complimentary Wireless

- **TWD 2019 Meeting Rooms/Foyer:** Complimentary Wireless; Conference passcode will be provided onsite at the meeting.

### AM/PM Beverage Breaks

All AM/PM beverage breaks are sponsored by Bethesda North Marriott Hotel & Conference Center.

### Twitter Hashtag - #TWD2019PDM
INSTRUCTIONS

There are three ways to use Poll Everywhere: via a free mobile app, on a web browser, or by text message. Poll Everywhere responses are not connected to your registration and are only linked by a participant ID—the only exception is if you enter your login information.

Mobile App

- The Poll Everywhere App is available via the iTunes Store or via Google Play.
- Once installed, you can choose to log in to an existing account (if you have one) or continue without logging in. Do not log in if you would like your responses to be anonymous.
- Click on "I'm Participating" and enter the meeting code username, twd1 or twd2, in the field provided to join a presentation.
- Active polls will automatically display for you to participate.

Web Browser

- Simply open your favorite web browser on your phone or computer and navigate to:
  
  https://pollev.com/twd1
  
  or
  
  https://pollev.com/twd2

- Active polls will automatically display for you to participate.

Text Messaging

- Text the meeting code: twd1 or twd2 to the number 22333 to join.
- As polls are activated, text your responses to the same number (22333). You will not receive any notice about new polls or when polls close. To change your answer for a poll, first type CLEAR then type your new response.
Joey Barnett, Ph.D., is a Professor of Pharmacology, Medicine, Pediatrics, and Pathology, Microbiology & Immunology at Vanderbilt University. Dr. Barnett received a Ph.D. in Pharmacology from Vanderbilt. He completed a postdoctoral fellowship and served as an Instructor at Harvard Medical School before returning to Vanderbilt. For over 25 years he has taught in courses, mentored students in the laboratory, participated in the evaluation of training programs, and developed and led innovative educational programs. He has directed NIH-funded pre- and postdoctoral training programs in Pharmacology, helped establish and co-direct Vanderbilt’s HHMI-funded Program in Molecular Medicine, and developed a joint Pharm.D., Ph.D. program with Lipscomb University. As Assistant Dean of Physician Researcher Training he developed and now oversees the required 4-year research curriculum for medical students. In 2005, he established the biennial National Meeting of Directors of Graduate Study in Pharmacology and Physiology. He reviewed training programs for NIGMS from 2009-14 and now chairs the NICHD T32 study section. He is an active member of ORPHEUS which advances Ph.D. training guidelines for the European Higher Education Area. Dr. Barnett serves on the FASEB Training Committee and the Executive Committee of ASPET’s Division of Pharmacology Education. In 2017 he was awarded the American Heart Association’s Louis B. Russell, Jr. Memorial Award for developing a research mentoring partnership with minority serving institutions. His exploration of the molecular and genetic pathways that regulate formation of the cardiovascular system were recognized by election as an AAAS Fellow in 2015.

Sherilynn Black, Ph.D., Associate Vice Provost for Faculty Advancement at Duke University, creates strategic initiatives and implements practices that support faculty development and advancement in many areas, including mentoring, support for pre-tenure and mid-career faculty, and career pathways and professional development for non-tenure system faculty. She also leads initiatives to increase diversity among the faculty ranks and further develop an inclusive climate within academic units. Dr. Black is an Assistant Professor of the Practice of Medical Education. Her research focuses on understanding effective ways to optimize interactions between faculty and trainees in mentoring relationships, and also on developing institutional models to increase effectiveness of interventions designed to promote diversity in academia.

Dr. Black previously served as the founding Director of the Office of Biomedical Graduate Diversity for the Duke University School of Medicine and provided intellectual and strategic leadership for all diversity initiatives for trainees and faculty in the basic science departments and programs. She was also a Principal Investigator of the Duke Initiative for Maximizing Student Development (IMSD) Program referred to as the Duke Biosciences Collaborative for Research Engagement (BioCoRE), which provided extensive mentoring and scientific engagement opportunities for diverse undergraduate/graduate students and faculty in the biomedical sciences. Dr. Black holds several national appointments relating to faculty development and advancement, including serving on advisory boards, developing strategic initiatives, and holding committee appointments with the National Institutes of Health, Howard Hughes Medical Institute, The Burroughs Wellcome Fund, the American Association of Medical Colleges, the National Academies of Sciences, Engineering and Medicine, the National Labs, and the Society for Neuroscience. She has won a number of distinctions for her work, including the Samuel Debois Cook Society award and the Deans Award for Inclusive Excellence in Graduate Education. Dr. Black earned her Bachelor of Science in Psychology and Biology with highest honors at the University of North Carolina at Chapel Hill and was a Morehead-Cain Scholar. She earned her PhD in Neurobiology at Duke University. She also completed additional studies in the School of Education at the University of North Carolina at Chapel Hill.

Dolores Bradley Brennan, Ph.D., received a B.A.in Psychology and a B.A. in English from Tennessee State University (Nashville, TN) where she was a participant in the MBRS (now RISE) and MARC undergraduate research training programs, which are sponsored by the National Institutes of Health (NIH). Dr. Bradley earned her Sc.M. and Ph.D. in Experimental Psychology from Brown University (Providence RI). As a graduate student, her academic honors included a Patricia Roberts Harris Fellowship, Ford Foundation Pre-doctoral Fellowship and a National Science Foundation (NSF) grant award. Her graduate work examined the relationship between visual perception and memory processes, as well as drug effects on visual processing. Dr. Bradley joined the Yerkes National Research Center of Emory University as a postdoctoral research training fellow in the Department of Ophthalmology in the School of Medicine and in the Department of Psychology of Emory University. She was part of a multidisciplinary team of visual psychophysicists,
neurophysiologists, neuro-anatomists and pediatric ophthalmologists, whose work focused on identifying treatments for childhood visual disorders related to early visual experience. Dr. Bradley was awarded a National Research Service Award (NRSA) grant from NIH to study the effects of abnormal visual input on eye growth and refractive development. After establishing her own laboratory at Yerkes, she began a second line of research concerned with using a monkey model to identify optimal treatment strategies for children who have strabismus (eye misalignment). Her primary research collaborations have included scientists and at Emory, the University of Houston, and Washington University in St. Louis MO. Dr. Bradley has been funded continually by NIH since graduate school, and is a current Principal Investigator (PI) on several grants. Dr. Bradley is a long-time grant review panelist for several federal funding agencies, including the National Science Foundation (NSF: GRFP, Neural Systems Cluster), the Howard Hughes Medical Institute (HHMI), and various program review panels of the NIH (NIGMS, NICHD, NCMHD).

In 2001, Dr. Bradley was recruited to join the Psychology faculty of Spelman College as an Assistant Professor. She was promoted to Associate Professor in 2005 and to Professor in 2010. She is the recipient of the Vulcan Materials Award for Teaching Excellence. From 2002-2005 Dr. Bradley served as the Director of the Extramural Associates Research Development Award (EARDA) Program, which was an NIH-supported faculty development grant. In 2005 she became the Director of the RISE Program at Spelman College, which is supported by the National Institute of General Medical Sciences (NIGMS) of the NIH. Her RISE program enjoys considerable success in preparing young women of African descent to enter and complete doctoral programs in the biomedical and behavioral sciences – it has served as a model for other RISE programs across the country. In 2011, Dr. Bradley was named to the newly created position of Director of Undergraduate Research at Spelman College. Her primary charge was to design and implement the campus-wide transformation of the curriculum, leading to a capstone undergraduate research experience in the major; this work has been supported by a grant from the Mellon Foundation. Dr. Bradley was elected Chair of the Psychology department for the term beginning August 2014. As the largest major on campus, she oversaw a population of over 400 students – in the past 15 years, one in every five graduates has been a psychology major.

Beginning in January 2016, Dr. Bradley Brennan was asked to serve as Special Assistant to the Provost, which was, initially, a part-time administrative position; by August 2016, her role was expanded to the full-time position of Interim Vice Provost – in this role she oversaw several budgets and initiatives concerned, primarily, with faculty development and the academic curriculum. Beginning August 2017, Dr. Bradley Brennan was promoted to the position of Vice Provost for Faculty, a role that heads up Faculty Support (recruitment, tenure and promotion, retirement) and Faculty Development, for the Office of the Provost.

**Andrew G. Campbell, Ph.D.,** is the fifteenth dean of the Graduate School of Brown University. His term began on July 1, 2016.

Dean Campbell is responsible for engaging and supporting more than 2,600 students enrolled in doctoral and master’s programs in more than 40 departments, centers and institutes, including the School of Engineering, the School of Public Health and the School of Professional Studies.

A Professor of Medical Science at Brown University, his research focuses on microbial diseases, particularly infectious diseases in neglected populations and regions. He has taught and advised Brown undergraduate and graduate students since his 1994 faculty appointment and has served as director of the University’s pathobiology program and the Marine Biological Laboratory graduate program. He is currently principal investigator of two federal National Institutes of Health (NIH) grants and he leads the NIH-funded Initiative to Maximize Student Development in Brown’s Division of Biology and Medicine, a program found to have significantly improved recruiting and performance of underrepresented minority students in doctoral programs. Campbell was educated at York College, City University of New York (biology, 1981), earned his Ph.D. from the University of California, Los Angeles (biology, 1987) and completed postdoctoral training at UCLA and at the University of California, San Francisco.

Campbell is the recipient of the National Science Foundation CAREER Award, American Foundations for AIDS Research Investigator Award, Harriet W. Sheridan Center Medal for Distinguished Contributions to Teaching and Learning at Brown University, and Brown’s Presidential Award for Excellence in Faculty Governance. His national engagement includes service to the NIH, the National Academy of Sciences and the National Science
Foundation. He is a member of the Howard Hughes Medical Institute Meyerhoff Adaptation Program advisory board as well as several professional societies. He is a Fellow of the American Society for Cell Biology and was also recently appointed to serve as member of the Board of Directors of the Council of Graduate Schools.

At Brown University, his past service includes the role of chair of the Sheridan Center for Teaching and Learning Advisory Board, vice chair of the University Resources Committee, and co-chair of the strategic planning committee for the current Brown Center for Students of Color.

Roger Chalkley, D.Phil., Senior Associate Dean, is responsible for the overview of the activities of the office of Biomedical Research Education and Training. These responsibilities include oversight of the Interdisciplinary Graduate Program (IGP), postdoctoral affairs, graduate student affairs as well as minority activities and supporting training grant applications.

Dr. Chalkley was educated at Pembroke College, Oxford in Chemistry and conducted post-doctoral research in gene regulation and chromatin structure in the laboratory of James Bonner at CalTech. After almost 20 years in the Department of Biochemistry at the University of Iowa School of Medicine, he moved to Vanderbilt in 1986. He has published almost 200 papers in chromatin research. Dr. Chalkley has had an active interest in graduate education for many years and was involved in the establishment of the IGP where he served as Director for eight years.

Gabriela Chavira, Ph.D., is a professor of Psychology at California State University Northridge (CSUN). She her doctorate in developmental psychology at the University of California Santa Cruz. Currently, she is a principal investigator and student training core co-director of the National Institutes of General Medical Sciences (NIGMS) undergraduate research training program, BUILD PODER, aimed at preparing historically underrepresented students for graduate studies. She uses Critical Race Theory (CRT) as a framework to engage diverse students, who would traditionally have not engaged in biomedical research, to major in biological, social and health sciences in order to increase the biomedical workforce. Her research is interdisciplinary examining the factors contributing to the wellbeing and achievement of immigrant youth in the US. She has served on SRA’s Diversity and Equity and Social Policy committees and is currently is on the editorial board of Cultural Diversity and Ethnic Minority Psychology.

Melanie M. Cooper, Ph.D., is the Lappan-Phillips Professor of Science Education and Professor of Chemistry at Michigan State University. Her research has focused on improving teaching and learning in large enrollment general and organic chemistry courses at the college level, and she is a proponent of evidence-based curriculum reform and assessment. She is a Fellow of the American Chemical Society, the American Association for the Advancement of Science, the Royal Society of Chemistry, and was a member of the National Academies of Science Advisory Board on Science Education (BOSE). She has received a number of awards including the American Chemical Society Award for Achievement in Research on Teaching and Learning in Chemistry (2014), the Norris award for Outstanding Achievement in Teaching of Chemistry (2013), and the Outstanding Undergraduate Science Teacher Award from the Society for College Science Teaching (2011), and was awarded an honorary D.Sc. from the University of South Florida (2016). She earned her B.S. M.S. and Ph.D. in chemistry from the University of Manchester, England.

Tiera S. Coston, J.D., Ph.D., is an Educational Improvement Specialist in the Center for the Advancement of Teaching and Faculty Development at the Xavier University of Louisiana. In Xavier’s BUILD Program, Project Pathways, she oversees the Preparing Mentors and Advisors at Xavier (P-MAX) Mentor Training, Entering Research at Xavier University of Louisiana (ER XULA) Mentee Training and Mentee-to-Mentor (M2M) Programs. She has served in higher education for more than 15 years, and her work focuses on the improvement of undergraduate STEM education and the use of mentoring to enhance student success. She is a National Research Mentoring Network (NRMN) Certified Facilitator who has conducted more than 100 workshops on a variety of mentoring- and teaching and learning-themed topics.

Carlos Crespo, Dr.P.H., M.S., FACSM, is Professor in the Oregon Health and Science University and Portland State University School of Public Health and Vice Provost for Undergraduate Training in Biomedical Research at Portland State University. He graduated from the Inter American University of Puerto Rico, and has a Master of Science in Sports Health from Texas Tech University and a Doctor of Public Health in Preventive Care from the Loma Linda University. Previous work experience includes working for the Centers
for Disease Control and Prevention at the National Center for Health Statistics and as a public health analyst for the National Institutes of Health. His main area of research involves the epidemiology of physical activity in the prevention of chronic diseases and research on minority health issues. He lists more than 100 publications and has been a contributing author to five textbooks on minority health and sports medicine, and more than 10 government publications, including the Surgeon General’s Report on Physical Activity and Health. He received the 1997 U.S. Secretary of Health Award for Distinguished Service as part of the Salud para su Corazón campaign, and in 2003 became a Minority Health Scholar from the National Institutes of Health. He is a former member of the National Advisory Council of the Robert Wood Johnson Foundation Active Living Research, Director of the World Health Organization Collaborating Center in Urban and Health Sustainability, Oregon Health Policy Board and is emeritus board member of the American Council on Exercise and the Oregon Public Health Institute. He is a Fellow of the American College of Sports Medicine, and serves on the Board of Trustees of the American College of Sports Medicine and in the Advisory Committee for the Community Guide for Physical Activity and the Built Environment for CDC. He is also in the Editorial Board of the Journal Cities and Health.

Angela DePace, Ph.D., received her B.S. in Molecular Biophysics and Biochemistry from Yale University, and her Ph.D. in Biochemistry from the University of California, San Francisco where she studied with Jonathan Weissman. She conducted her postdoctoral work at the University of California Berkeley with Michael Eisen. Angela is an expert in science communication; she co-authored Visual Strategies: A Practical Guide to Graphics for Scientists and Engineers and co-teaches a scientific communication course for Systems Biology graduate students with Galit Lahav and Allon Klein. She received an NSF CAREER award in acknowledgement of her research and innovative teaching. Her lab is highly collaborative and committed to strong mentoring as described in Yearly Planning Meetings: Individualized Development Plans Aren't Just More Paperwork.

Erin Dolan, Ph.D., is a Professor of Biochemistry & Molecular Biology and Georgia Athletic Association Professor of Innovative Science Education at the University of Georgia (https://research.franklin.uga.edu/erindolan/). As a graduate student in Neuroscience at University of California San Francisco, she volunteered extensively in K-12 schools, which prompted her to pursue a career in biology education. She teaches introductory biology and biochemistry, and her research group studies undergraduate research experiences and mentoring of undergraduate and graduate researchers in the life sciences, especially related to students’ psychosocial and sociocultural development. She has designed and led a wide range of professional development on active learning and mentoring, including intensive sessions for faculty to develop course-based undergraduate research experiences. Her group’s research and programming has been sponsored by the National Science Foundation, the National Institutes of Health, and the Howard Hughes Medical Institute. She is also Editor-in-Chief of the leading biology education journal, CBE – Life Sciences Education (http://www.lifescied.org/).

Lourdes E. Echegoyen, Ph.D., is the 2010 founding director of the Campus Office of Undergraduate Research Initiatives (COURI) at the University of Texas at El Paso (UTEP). COURI’s mission is to provide undergraduate students with impactful learning experiences through research, scholarly and creative activities, under the mentorship of faculty, and in collaboration with UTEP academic leaders, advisors and other supporting units. Dr. Echegoyen has 17 years of experience directing externally funded undergraduate research programs. Since her arrival at UTEP, Dr. Echegoyen has received several awards as PI or Co-PI from the National Science Foundation, the National Institutes of Health, the Howard Hughes Medical Institute, and the Department of Energy, all of which are focused on undergraduate research training in the sciences and engineering. She has led several initiatives at UTEP, including a Freshman Year Research Intensive Sequence (FYRIS), an undergraduate research tracking system at the campus-wide level, a series of professional development workshops for undergraduate researchers, and the use of a large portion of the funds from the on-campus student employment program to financially support undergraduate researchers from all disciplines, regardless of citizenship status.

In the past 5 years, a multi-million dollar project, funded by the National Institutes of Health in 2015 as part of their Diversity Program Consortium, has allowed Lourdes and her team of multiple PIs to develop the BUILDing SCHOLARS Center at UTEP. The center has implemented institutional, faculty and student development programs that are positively transforming the training of the next generation of biomedical researchers from the US Southwest region. In 2018, Dr. Echegoyen led conversations with UTEP higher
administrators that led to their commitment to sustain center programs that have demonstrated successful outcomes.

Lourdes is an avid hiker, has traveled around the world, and is passionate about many things, including her family, her work, science, nature, democracy, education, international cooperation through research, and dancing.

**Edgardo Falcón, Ph.D.**, is a neuroscientist and program director in the Postdoctoral Training Branch of the Division of Training, Workforce Development, and Diversity. He manages the Innovative Programs to Enhance Research Training (IPERT) R25 program, Research on Interventions (R01), Pathway to Independence (K99/R00) grants, and the NIH Diversity Program Consortium's National Research Mentoring Network. Before joining NIGMS, Falcón was a health program specialist in the Office of Programs to Enhance Neuroscience Workforce Diversity at the National Institute of Neurological Disorders and Stroke. Prior to that, Falcón conducted postdoctoral research at the University of Pennsylvania. He earned a B.S. in biology at the University of Puerto Rico, Rio Piedras Campus, and Ph.D. in neuroscience from the University of Texas Southwestern Medical Center at Dallas.

**Cynthia Fuhrmann, Ph.D.**, is Assistant Dean of Career and Professional Development and Associate Professor of Biochemistry and Molecular Pharmacology at University of Massachusetts Medical School in Worcester, MA. She has 15 years of experience directing programs in professional skills training and career planning for early-career biomedical scientists, including at University of California San Francisco (where she established UCSF’s Preparing Future Faculty program) and at UMassMed. She founded and directs UMassMed’s Center for Biomedical Career Development, which serves the campus’s ~600 graduate students and postdocs while acting as a scholarly incubator for educational approaches in PhD career development. Her work in this area has been funded by the NIH, NSF, and Burroughs Wellcome Fund. Fuhrmann’s 2011 study on the career interests of biomedical PhD students contributed to the growing national dialog about the training needs of PhD scientists. She co-authored myIDP, an interactive career-planning website hosted by the American Association for the Advancement of Science (AAAS), and continues scholarship in the use of Individual Development Plans. She serves on advisory boards for the Association of American Universities’ PhD Education Initiative, the Texas A&M AGEP Alliance, UMassMed’s IMSD and PREP programs, and various T32 programs. She is active in the Graduate Career Consortium, AAMC GREAT Group, and NIH BEST Consortium, and engaged in national initiatives to bring together stakeholders to further advance PhD career development in the sciences. Fuhrmann holds a BS in Chemistry from University of California Davis and a PhD in Biochemistry and Molecular Biology from UCSF.

**Alison Gammie, Ph.D.**, is director of the NIGMS Division of Training, Workforce Development, and Diversity, which supports the Institute's research training, career development and diversity-building activities through a number of programs at the undergraduate, graduate, postdoctoral and faculty levels.

Prior to joining NIGMS, Gammie served as a senior lecturer in molecular biology at Princeton University, where she also directed the university's Program for Diversity and Graduate Recruitment in Molecular and Quantitative Biology and its Summer Undergraduate Research Program in Molecular and Quantitative Biology. She was also an associate clinical member at the Cancer Institute of New Jersey. Her research focused on understanding how defects in DNA mismatch repair lead to cancer.

Gammie earned a B.A. in biology from Reed College and a Ph.D. in molecular biology from Oregon Health Sciences University. She conducted postdoctoral research at Princeton University.

**Bennett B. Goldberg, Ph.D.**, was born in Boston, MA in 1959, and is a life-long Red Sox fan. He received a B.A from Harvard College in 1982, and an M.S. and Ph.D. in Physics from Brown University in 1984 and 1987. Following a Bantrell Post-doctoral appointment at the Massachusetts Institute of Technology and the Francis Bitter National Magnet Lab, he joined the physics faculty at Boston University in 1989 and was appointed as Director of STEM Education Initiatives in 2012. He joined Northwestern University in August 2016 as the new Director of the Searle Center for Advancing Learning and Teaching, Assistant Provost for Learning and Teaching, and Professor of Physics and Astronomy. Goldberg is a Fellow of the American Physical Society and a United Methodist Teacher/Scholar of the Year, has been awarded a Sloan Foundation Fellowship, and is a recipient of the Presidential Young Investigators Award.
At Boston University, Goldberg became a Professor of Physics, Professor of Biomedical Engineering, Professor of Electrical and Computer Engineering, Professor of Education, and Professor of Graduate Medical Sciences. He was chair of the Physics Department, Director and founder of Boston University's Center for Nanoscience and Nanobiotechnology, and Director and founder of BU's nanomedicine program. Goldberg was the inaugural Director of STEM Education Initiatives in the Office of the Provost, working with colleges, departments, and faculty in transforming courses to increase the amount of evidence-based and active-learning in STEM instruction, as well as to develop and implement training in teaching and learning for STEM PhDs and postdocs — our nation's future faculty — and in creating classrooms that are inclusive to a diverse student body.

Goldberg's research interests are in the areas of nano-optics and spectroscopy of two-dimensional crystals, exploring strain and friction in single-atom-thick layers. He is engaged in projects in near-field and solid immersion imaging, using super-resolution techniques to break the diffraction limit, and imaging through strongly scattering media like tissue and rock; and active research on novel approaches to subcellular imaging, biosensors, and single-virus imaging.

Nationally, Goldberg has been active in building a network of universities preparing future faculty to be excellent researchers and excellent teachers, has co-authored two massive open online courses (MOOCs) for PhDs and postdocs on STEM learning and teaching, and is involved in bringing together cross-sector organizations to scale effective strategies for increasing access to higher education for underrepresented groups.

Sarah Goodwin, Ph.D., is a leader in science communication, training, and education. As the founding Executive Director of iBiology, she has worked with hundreds of scientists from around the world to help communicate their research and interests to a diverse and growing global audience. As the PI for an NIGMS IPERT grant, Sarah pioneered two innovative online courses for professional development of grad students and postdocs, "Planning Your Scientific Journey" and "Let's Experiment: A Guide for Scientists Working at the Bench." She also served as producer and chief science advisor of the upcoming documentary about genome editing, "Human Nature." Sarah received her PhD in Cell Biology from the University of California, San Francisco.

Giovanna Guerrero-Medina, Ph.D., is the Executive Director of Ciencia Puerto Rico www.cienciapr.org), an international network of >10,000 scientists, students and educators with ties to Puerto Rico, who are committed to promoting scientific outreach, education and careers. She is also Director of the Yale Ciencia Initiative at Yale University, where she studies the impact of scientific networks like Ciencia Puerto Rico in improving access and participation in science and works to promote diversity through the Office of Diversity and Inclusion of the Yale School of Medicine. Under her leadership, Ciencia Puerto Rico has become one of the largest networked communities of Hispanic scientists in the world, the most popular science website among Puerto Rico audiences, and has received recognition as Science Defender in 2018 from the Union of Concerned Scientist and as a Bright Spot in science education for Hispanics in 2015 by the White House. At Yale, Dr. Guerrero-Medina is Principal Investigator of the Yale Ciencia Academy, an NIH-funded program that provides biomedical PhD students with opportunities for professional development, outreach leadership, and networking. She also leads the National Science Foundation funded Ciencia al Servicio program, to promote collaborations between scientists and teachers so that students in Puerto Rico have access to culturally-relevant, engaging and effective science lessons. Dr. Guerrero-Medina’s career spans positions in government, non-profit, and academic settings. She has a B.S. in Biology from the University of Puerto Rico, Rio Piedras and received her Ph.D. in Molecular Biology from the University of California, Berkeley.

Joshua Hall, Ph.D., is Director of Graduate Admissions and the Post-baccalaureate Research Education Program (PREP) at UNC School of Medicine. He received his Ph.D. in Microbiology and Immunology from UNC Chapel Hill and was a SPIRE (IRACDA) postdoctoral fellow also at UNC. Josh has several recent publications on various aspects of science training and graduate admissions. For the past nine years, he directed North Carolina DNA Day, an annual event that sends over 150 scientists to high school classrooms across North Carolina. Josh is passionate about helping science trainees succeed and is actively involved in research on factors that contribute to success and productivity in biomedical graduate school. In addition, he is the creator and host of the podcast, Hello PhD, which explores the human side of science and life in the lab!
Robert Kelly, Ph.D., is currently Alcoa Professor of Chemical and Biomolecular Engineering at North Carolina State University. He also serves as Director of the campus-wide Biotechnology (BIT) Program, which educates over 400 undergraduate, graduate and postdoctoral students annually in molecular biology laboratory skills. Since 2000, he has been Program Director for an NIH T32 Biotechnology Training Program and a US Department of Education GAANN Fellowship Program. Kelly’s research on the biology and biotechnology of extremely thermophilic microorganisms has been recognized by national and international awards, including American Institute of Chemical Engineering’s Food, Pharmaceutical and Bioengineering Award, the American Chemical Society’s Marvin Johnson Award in Biochemical Technology, and the American Society for Microbiology’s DuPont Industrial Biosciences Award. He is currently an editor for Applied and
Environmental Microbiology. Kelly holds Bachelor's and Master's degrees in chemical engineering from the University of Virginia, and a PhD in chemical engineering from North Carolina State University.

Jon Lorsch, Ph.D., became the director of the National Institute of General Medical Sciences (NIGMS) in August 2013. In this position, Lorsch oversees the Institute's $2.5 billion budget, which supports basic research that increases understanding of biological processes and lays the foundation for advances in disease diagnosis, treatment and prevention. Lorsch came to NIGMS from the Johns Hopkins University School of Medicine, where he was a professor in the Department of Biophysics and Biophysical Chemistry. He joined the Johns Hopkins faculty in 1999 and became a full professor in 2009. A leader in RNA biology, Lorsch studies the initiation of translation, a major step in controlling how genes are expressed. When this process goes awry, viral infection, neurodegenerative diseases and cancer can result. To dissect the mechanics of translation initiation, Lorsch and collaborators developed a yeast-based system and a wide variety of biochemical and biophysical methods. The work also has led to efforts to control translation initiation through chemical reagents, such as drugs. Lorsch continues this research as a tenured investigator in the NIH's Eunice Kennedy Shriver National Institute of Child Health and Human Development.

Lorsch received a B.A. in chemistry from Swarthmore College in 1990 and a Ph.D. in biochemistry from Harvard University in 1995, where he worked in the laboratory of Jack Szostak, Ph.D. He conducted postdoctoral research at Stanford University in the laboratory of Daniel Herschlag, Ph.D. Lorsch is the author of more than 70 peer-reviewed research articles, book chapters and other papers. He has also been the editor of six volumes of Methods in Enzymology and has been a reviewer for numerous scientific journals. He is the author on two awarded U.S. patents. His honors include six teaching awards from Johns Hopkins.

Lorsch's other activities have included membership on the American Society for Biochemistry and Molecular Biology's mentoring committee, the RNA Society's board of directors and NIH review committees. Since joining NIH, he has taken on several leadership roles, including serving on the NIH Scientific Data Council, Administrative Data Council and Extramural Activities Working Group, which he co-chairs.

P. Kay Lund, Ph.D., is Director of a new Division of Biomedical Research Workforce in the Office of Extramural Research at the National Institutes of Health (NIH). The division has responsibilities for policy and extramural programs related to training, career development and diversity of the biomedical research workforce. The division also performs research and economic analyses to predict workforce trends and future needs.

Dr. Lund joined NIH from a career in academia including appointments at the Massachusetts General Hospital and University of North Carolina at Chapel Hill. She has mentored large numbers of biomedical researchers from undergraduate students to faculty including Ph.D. and MD scientists. Dr. Lund has published widely in her scientific discipline and has also written articles about broadening definitions of career outcomes for Ph.D. scientists see (The Flexible Ph.D. Gastroenterology, 203 125:1301).

Dr. Lund serves as co-chair of the NIH Working Group on Strengthening the Biomedical Workforce which advises on the BEST program geared towards Broadening Experiences in Scientific Training.

Kim McCall, Ph.D., is Professor and Chair of Biology at Boston University. She received her B.S. in Biology from the State University of New York, College at New Paltz, her Ph.D. in Genetics from Harvard University and was a Postdoctoral Fellow at M.I.T. She joined the faculty at Boston University in 1998. She served as Director of the interdisciplinary Molecular Biology, Cell Biology and Biochemistry Graduate Program from 2005-2007, was Director of Graduate Studies in Biology from 2010-2015, and was appointed Chair of Biology in 2016. Her research focuses on cell death and phagocytosis using Drosophila melanogaster as a model system, and she has over 50 publications. She was elected the Northeast Representative of the Drosophila Board in 2017. She has taught courses in Genetics, Developmental Biology, Cell Biology, Molecular Biology, and Cancer Biology. Dr. McCall has served on the advisory committee of over 80 Ph.D. students, and has trained 18 Ph.D. students, 14 Master's students and over 50 undergraduate researchers in her own lab, many of them women and members of groups under-represented in STEM. She received the Boston University College Prize for Excellence in Student Advising in 2007. She has served on a number of committees at BU including the Academic Policy Committee, the University Council Committee on Graduate Academic Programs and Policies, the University Appointments, Promotion and Tenure Committee, Strategic Planning Task Force
and the steering committee of BU’s BEST, an NIH-funded program aimed at training graduate students and postdocs for a wide range of careers. She has served on several NIH and American Cancer Society grant review panels, and has reviewed for over 35 different scientific journals. Her research has been supported by the March of Dimes, American Cancer Society, and NIGMS.

Richard (Rick) McGee, Ph.D., is currently the Associate Dean for Professional Development at Northwestern University Feinberg School of Medicine. In that role, his primary responsibility is to support the development of independent research programs of early career faculty. To achieve this, he has developed a novel approach to teaching grant wiring by leading coached writing groups that last 2-4 months. At any point in time 4-6 groups will be ongoing with 3-6 people/group. His career path to creating this unique role began with 20 years of laboratory research in basic neuroscience and cellular pharmacology. His roles then evolved to designing and leading research training at multiple levels, during which he began developing novel coaching models to complement research mentoring. During this evolution, he became interested in actually studying how young scientists develop using sophisticated qualitative research methods and established social science theories and models. A strong theme throughout his career has been in diversity efforts related to both gender and racial/ethnic equality. Today, in addition to his professional development role, he leads a team of social science and education researchers in the NIH-funded National Longitudinal Study of Your Life Scientists. They are also following the outcomes of PhD students who took part in a novel career coaching experiment, The Academy for Future Science Faculty. Dr. McGee also leads a diversity-focused professional development program for early PhD students at Northwestern (the CLIMB program), and is deeply involved with new approaches to promoting effective mentoring relationships, culturally aware mentorship, and grant writing skills through the National Research Mentoring Network (NRMN).

Craig A. Merlic, Ph.D., obtained his B.S. degree in chemistry from the University of California, Davis and his Ph.D. in organic chemistry as a Hertz Foundation Fellow at the University of Wisconsin, Madison. After a National Institutes of Health Postdoctoral Fellowship at Princeton University he joined the faculty in the UCLA Department of Chemistry and Biochemistry. Professor Merlic directs a research group that focuses on applications of transition metal organometallic chemistry to organic synthesis. His most recent work focuses on copper, iridium and palladium catalyzed cross coupling reactions. He has published more than 70 papers in peer-reviewed journals and received a National Science Foundation Young Investigator Award, an Alfred P. Sloan Research Fellowship, and a Camille Dreyfus Teacher-Scholar Award. His research has been supported by the National Science Foundation, the National Institutes of Health, the Petroleum Research Fund and various corporate sponsors. He created award-winning Internet-based educational projects for course management and teaching spectroscopy in organic chemistry. These projects earned a MERLOT Award for Exemplary Online Learning Resources, a StudySphere Award of Excellence and a StudyWeb Excellence Award. In addition, he received a Hanson-Dow Award for Excellence in Teaching from the Department of Chemistry and Biochemistry for his in-class teaching.

Professor Merlic has been very active promoting chemical safety at UCLA, the University of California system, and academic institutions nationwide. He serves as chair of the Department Safety Committee, chair of the campus-wide Chemical and Physical Safety Committee, and member of the UCLA Safety Oversight Committee. At the University of California system-wide level, he is the executive director of the UC Center for Laboratory Safety that has ongoing projects to improve laboratory safety policies, procedures, and training based on scientific studies. Through the Center, he also manages the Safety Training Consortium that provides safety training courses to several dozen universities across the nation (http://safety-consortium.org).

Frederick Meyers, MD, MACP is the Director of the Center for Precision Medicine and Data Sciences, and Professor of Internal Medicine / Hematology-Oncology at the UC Davis School of Medicine. He has a long-standing interest in cancer biology, clinical trials, and palliative care with a focus on advanced and metastatic malignancies. In the 1980s he founded one of the first Palliative Care centers in the country. He was part of the leadership team that achieved the nationwide status of Comprehensive Cancer Center for UC Davis.

He has a distinguished record of education and workforce development, and is nationally known for leading innovative research career development training programs for physician scientists and pre and postdoctoral fellows. Dr. Meyers has served as Director of Research Education and Career development in the UC Davis Clinical and Translational Science Center (CTSC) since its inception. His appointment as Associate Director
for Cancer Education, Training and Workforce Development unites the CTSC and Comprehensive Cancer Center research education efforts.

His service to the University has included 12 years as Chair of the Department of Internal Medicine followed by 7 years as Executive Associate Dean and Vice Dean of the UC Davis Medical School.

As of 2016, with the advent of the United States Precision Medicine Initiative, Dr. Meyers was asked to lead and integrate precision medicine across all of the colleges and schools at UC Davis and the communities it serves. The award of the Arline Miller Rolkin Professorship in Clinical Effectiveness underscores his commitment to take science to the bedside. He has developed a network among the UCs, the state, and other partners, making the UC Davis Center for Precision Medicine and Data Sciences a leader in precision medicine. He stated, “When I started my career, it was difficult to provide high-quality cancer care, with a cure rate of less than 50 percent. Now, the rate is up to 75 percent. But the truth is, I don’t ever want to see another cancer case—I want to prevent it. For those individuals still left without a cure, we need precision medicine to make the next great leap in care.” As a true physician, finding precise, targeted and individualized cures for cancer and all disease, and achieving population health, remains his enduring passion.

In sum, Professor Meyers is a very well-respected internist, oncologist, an expert in precision medicine, and an academician with outstanding records of mentoring and of representing the UC Davis School of Medicine at the national level, publishing frequently on clinical effectiveness research topics.

Sharon Milgram, Ph.D., received a B.S. in physical therapy from Temple University in 1984 and a Ph.D. in cell biology from Emory University in 1991. She completed a postdoctoral fellowship at The Johns Hopkins University before joining the faculty at The University of North Carolina (UNC) at Chapel Hill in 1994.

At UNC, Dr. Milgram rose to the rank of Full Professor with Tenure in the Department of Cell & Developmental Biology. Dr. Milgram founded and advised the UNC Office of Postdoctoral Services and served on the advisory committee of the Sigma Xi National Postdoc Survey. In 2007 Dr. Milgram joined the NIH Office of the Director as the Director of the Office of Intramural Training and Education. There she directs a trans-NIH Office dedicated to the career advancement of over 5000 trainees, ranging from high school and college students to postdoctoral and clinical fellows. Dr. Milgram frequently gives lectures on science careers, mentorship, leadership, and management in research environments.

Nancy P. Moreno, Ph.D., is Associate Provost of Faculty Development and Institutional Research, and Professor of Health Professions and Family & Community Medicine at Baylor College of Medicine. Trained as a biologist, she has devoted most of her career to science and health education, and is Senior Associate Director of Baylor’s Center for Educational Outreach. Her funded research has included development of interdisciplinary science educational materials, creation of local school and national partnerships to promote systemic change in STEM teaching and learning, and application of web-based technologies for educator support and professional development. Many of these efforts have been directed toward improving access by students at all levels to careers in STEM and the health professions. In her current role as Associate Provost, she guides career advancement, leadership development, educational innovation and recognition of Baylor faculty members. Dr. Moreno is principal investigator of education partnerships funded by the Science Education Partnership Award Program of the National Institute of General Medical Sciences (NIH), BHP Billiton and Phillips 66, and has received support from Howard Hughes Medical Institute, National Institute on Drug Abuse (NIH), National Institute of Allergy and Infectious Diseases (NIH), National Institute of Environmental Health Sciences, Agency for Healthcare Research and Quality, National Space Biomedical Research Institute and National Science Foundation, among others. She is a Fellow of the American Association for the Advancement of Science and in 2010 received the Barbara and Corbin J. Robertson, Jr. Presidential Award for Excellence in Education, Baylor’s most prestigious award for faculty educational contributions. She received her Bachelor's degree in botany with distinction from the University of Wisconsin-Madison, and earned her Ph.D. in biology from Rice University.

Link to Baylor Faculty page: https://www.bcm.edu/people/view/nancy-moreno-ph-d/b228db2d-ffed-11e2-be68-080027880ca6
Carol B. Muller, Ph.D., is Executive Director of WISE Ventures. Dr. Muller joins with individuals and organizations at Stanford to amplify the impact of programs, research, and other projects to advance equity in science, technology, engineering, and mathematics (STEM) fields, and works collaboratively to enhance existing and establish new initiatives to meet needs aligned with this mission for Stanford University. She also provides executive support for Stanford’s Faculty Women’s Forum and serves as a lecturer in the Department of Mechanical Engineering.

Coupling leadership experience across a wide range of responsibilities in higher education with entrepreneurial skills honed through her work in engineering education, she founded MentorNet in 1997, a nonprofit online global mentoring network supporting diversity in science and engineering, serving as its chief executive until 2008. Her prior work includes service as consulting professor of mechanical engineering at Stanford University, as associate dean for administration at Thayer School of Engineering at Dartmouth College (where she co-founded the Dartmouth Women in Science Project and the Dartmouth Project for Teaching Engineering Problem-Solving), and as department manager for Stanford’s Electrical Engineering department.

A Fellow of the Association for Women in Science, her work has been recognized with national awards, including the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring, and the Anita Borg Social Impact Award. She has authored and presented numerous papers, presentations, and workshops, and has created projects, programs, and fellowships developed with funding from private foundations, corporations, and the federal government, contracts, and individuals. She earned a bachelor’s degree from Dartmouth College and A.M. and Ph.D. degrees in education administration and policy analysis at Stanford University.

Christine Ortiz, Ph.D., is a scientist, engineer, professor, scholar, and social entrepreneur. Ortiz is the (tenured and chaired) Morris Cohen Professor of Materials Science and Engineering at the Massachusetts Institute of Technology. Ortiz is the founder of a new nonprofit institution, Station1 (www.station1.org), that is building a new model of higher education and a foundation for the university of the future through an integrated, interdisciplinary approach to socially-directed science and technology education, research, and entrepreneurship.

Ortiz served as the Dean for Graduate Education at MIT between 2010 and 2016, supporting approximately 7,000 graduate students from 100+ countries. With over 25 years of experience in higher education, Dr. Ortiz has led cross-institutional initiatives in global education, technology-enabled learning, new methods of learning assessment, fostering diversity and inclusion and postsecondary financial models. Ortiz has served on over 50 MIT departmental and Institute committees and working groups.

As a Professor of Materials Science and Engineering at MIT, Ortiz is a distinguished scientist and engineer with over 175 scholarly publications, has supervised the research projects of more than 80 students from 10 different academic disciplines, and received 30 national and international honors, including the Presidential Early Career Award in Science and Engineering which was awarded to her at the White House by President George W. Bush. She is the founder and faculty director of the MIT International Science and Technologies Initiatives – Israel program which has given approximately 600 students global internship opportunities. Ortiz serves on numerous boards, including as a regional accreditation commissioner for the Commission on Institutions of Higher Education, New England Association of Schools and Colleges.

Christine Pfund, Ph.D., is a senior scientist with the Wisconsin Center for Education Research and the Department of Medicine at the University of Wisconsin-Madison (UW). Dr. Pfund earned her Ph.D. in Cellular and Molecular Biology, followed by post-doctoral research in Plant Pathology, both at University of Wisconsin-Madison. For almost a decade, Dr. Pfund served as the Associate Director of the Delta Program in Research, Teaching, and Learning and the co-Director of the Wisconsin Program for Scientific Teaching helping to train future faculty to become better more effective teachers. Dr. Pfund is now conducting research with several programs across the UW campus including the Institute for Clinical and Translational Research and the Center for Women’s Health Research. Her work focuses on developing, implementing, documenting, and studying interventions to optimize research mentoring relationships across science, technology, engineering, mathematics, and medicine (STEMM). Dr. Pfund co-authored the original Entering Mentoring curriculum and co-authored several papers documenting the effectiveness of this approach. Currently, Dr. Pfund is co-leading two studies focused on the impact of training on both mentors and mentees and understanding specific factors
in mentoring relationships that account for positive student outcomes. Dr. Pfund is one of the principal investigators of the National Research Mentoring Network (NRMN). She is also director of the Center for the Improvement of Mentored Experience in Research at UW-Madison (CIMER). She is currently serving on a committee of the National Academies to explore the science of effective mentoring in STEMM.

Rajini Rao, Ph.D., is professor of Physiology at the Johns Hopkins University School of Medicine in Baltimore, Maryland. Her laboratory investigates ion transporters in human disease, ranging from cancer to neurodegeneration. Dr. Rao is an active educator and mentor. In her role as principal investigator and director of the NIGMS-funded T32 training program in Cellular & Molecular Medicine, she oversees a multi-departmental program that includes 125 faculty and 130 Ph.D. students. Rao is a long standing advocate for women in science, having chaired the Committee on Professional Opportunities for Women at the Biophysical Society for nearly a decade, and co-founded stemwomen.net, a site that raises awareness for gender disparity in STEM. She is a frequent panelist and speaker on gender equity at local and international STEM venues. Rao has held multiple elected leadership roles in the Biophysical Society, chaired FASEB and Gordon conferences, and served on journal editorial boards and grant review panels at the NIH, DOD, and HHMI, including the NIGMS TWD-A review panel for T32 training grants.

Desirée Salazar, Ph.D., is a program director in the Division of Training, Workforce Development, and Diversity. She administers Innovative Programs to Enhance Research Training (IPERT) and Building Infrastructure Leading to Diversity (BUILD) grants and Institutional Research and Academic Career Development Awards (IRACDA) awards. Salazar also manages Research Supplements to Promote Diversity in Health-Related Research and Research Supplements to Promote Re-entry into Biomedical and Behavioral Research Careers program and oversees predoctoral T32 cellular, biochemical and molecular sciences grants. She also manages research grants in the area of stem cell biology and regeneration in the Division of Genetics and Molecular, Cellular, and Developmental Biology.

Salazar was most recently a scientific program manager at the American Society for Cell Biology. Formerly, she was a program education coordinator for the Institutional Research and Academic Career Development Awards (IRACDA) program at the University of California, San Diego. She earned a B.S. in neuroscience from the University of California, Los Angeles, and a Ph.D. in biological sciences from the University of California, Irvine. Salazar conducted postdoctoral research and was an IRACDA fellow at the University of California, San Diego.

Jason Sheltzer, Ph.D., is an Independent Fellow at Cold Spring Harbor Laboratory. His laboratory studies the consequences of gene dosage imbalances during tumorigenesis, and his work is supported by grants from the NIH, the DoD, the Damon-Runyon Foundation, the AACR, and the Breast Cancer Alliance. He obtained a B.A. in Molecular Biology from Princeton University and a Ph.D. in Biology from the Massachusetts Institute of Technology. Dr. Sheltzer is also a recent recipient of the Presidential Early Career Award for Scientists and Engineers, the highest honor bestowed by the United States government on outstanding scientists and engineers in the early stages of their independent research careers.

Ann Stock, Ph.D., is Professor of Biochemistry and Molecular Biology at Rutgers-Robert Wood Johnson Medical School and Resident Member of the Center for Advanced Biotechnology and Medicine (CABM). Together with Martin Yarmush, M.D., Ph.D., she co-directs the Rutgers Graduate Training Program in Biotechnology. Dr. Stock's research on bacterial signal transduction has been funded by the NIH, NSF, Howard Hughes Medical Institute and other foundations. She is an Editor for *Journal of Bacteriology*, Advisory Board and Editorial Board Member for *PLoS Biology*, and Faculty Member of F1000. Dr. Stock is a member of the Peer Review Committee for the Life Sciences Research Foundation and chair of the External Advisory Committee for the Oklahoma COBRE in Structural Biology at the University of Oklahoma. She has served on NIH and NSF review panels, including as member and chair of the NIH-NIDCR Board of Scientific Counselors. She served on the American Society for Biochemistry and Molecular Biology (ASBMB) Education and Professional Development Committee for more than 10 years and currently serves on the ASBMB subcommittee for Accreditation of Biochemistry and Molecular Biology Undergraduate Programs and on the FASEB subcommittee on Training and Career Opportunities for Scientists.

Dr. Stock obtained an A.B. in Biochemistry in 1979 and a Ph.D. in Comparative Biochemistry in 1986 from the University of California, Berkeley. She did postdoctoral work as a Damon Runyon Cancer Research Fellow at
Princeton University and as a Lucille P. Markey Scholar at Brandeis University before joining the CABM at Rutgers University in 1991.

**Susan Strome, Ph.D.**, is a distinguished professor in the Department of Molecular, Cell and Developmental (MCD) Biology at the University of California Santa Cruz. Her lab’s research focuses on chromatin-based epigenetic inheritance, using C. elegans as a model. She is the Chair of the MCD Biology Graduate Advising Committee and Director of the NIH T32 Training Program in MCD Biology.

**JoAnn Trejo, Ph.D., M.B.A.**, is a professor of Pharmacology and assistant vice chancellor for Health Sciences Faculty Affairs at UC San Diego. In 2014, she was appointed Vice Chair of the Department of Pharmacology, associate dean for Health Sciences Faculty Affairs in 2015, and assistant Vice Chancellor for Health Sciences Faculty Affairs in 2019. Dr. Trejo is a basic science researcher with expertise in cell signaling by G protein-coupled receptors in the context of vascular inflammation and cancer. Her research has been continuously funded by the NIH, including a recent NIGMS R35 Outstanding Investigator Award. She was the recipient of the prestigious American Heart Association Established Investigator Award and the American Society for Cell Biology EE Just Award for outstanding scientific achievement. As assistant vice chancellor, Dr. Trejo is responsible for developing and implementing strategies, initiatives and programs for enhancing the success, recruitment and retention of an engaged diverse faculty within Health Sciences. Dr. Trejo is also an excellent educator, mentor and a leader actively engaged in numerous initiatives aimed at enhancing the inclusive excellence of UC San Diego. She is the principal investigator of an NIGMS K12 IRACDA postdoctoral training program, NHLBI R25 PRIDE early career academic program and a summer undergraduate program in pharmacology, these programs promote the career development and success of women and underrepresented minorities in biomedical sciences. In 2014, Dr. Trejo received the UC San Diego Chancellor’s Award for Excellence in Postdoctoral Scholar Mentoring and the UC San Diego Inclusive Excellence Award in 2016. Dr. Trejo is Mexican-American, a native of California and was the youngest of five children in a family of migrant farm workers raised by a single mother. She earned her BS at UC Davis, PhD and MBA at UC San Diego. She completed her postdoctoral fellowship at UC San Francisco. She was elected to serve on leadership Council for the American Society for Cell Biology and leadership Council for the American Society for Biochemistry and Molecular Biology. Dr. Trejo has also served on multiple NIH and HHMI Study Sections and currently serves on the NCI Board of Scientific Counselors for Basic Sciences.

**Linda Gutierrez-Tunstad, Ph.D.**, is Professor of Chemistry and Biochemistry at California State University Los Angeles. She has been Director of Bridges to the Baccalaureate at Cal State LA since 1996 after serving as Associate Director since 1993. A first-generation Angeleno of Mexican and Norwegian heritage, she is the fifth of ten siblings. She earned the B.S. chemistry degree at Cal State Los Angeles as a MARC Scholar after beginning college as a biology major. She was the first Latina to earn the Ph.D. in Chemistry at UCLA in 1990 and was supported with a MARC Predoctoral Fellowship. Her research advisor was Nobel Laureate Donald J. Cram. Post-doctoral studies were conducted at UC Berkeley in bio-inorganic chemistry with Kenneth Raymond. Dr. Tunstad joined the faculty at Cal State Los Angeles in 1992. Her research group investigates structural design effects on molecular capsule conformational switching with implications for controlled selective binding. The MORE Programs at Cal State LA is home to the NIH RISE, MARC and Bridges Programs and was founded by Dr. Carlos Gutierrez in 2000. In 2018, Dr. Tunstad became Co-Director of the MORE Programs and also assumed the Directorship of the MARC USTAR Program after serving as Associate Director.

**Hannah Valantine, M.D., M.R.C.P., F.A.C.C.**, received her M.B.B.S. degree (Bachelor of Medicine, Bachelor of Surgery; the United Kingdom’s equivalent to an M.D.) from St. George’s Hospital, London University in 1978. After that, she moved to the University of Hong Kong Medical School for specialty training in elective surgery before returning to the U.K. She was awarded a diploma of membership by the Royal College of Physicians (M.R.C.P.) in 1981. In addition, she completed postgraduate training and numerous fellowships, serving as senior house officer in Cardiology at Brompton Hospital and Registrar in Cardiology and General Medicine at Hammersmith Hospital. In 1985, Dr. Valantine moved to the United States for postdoctoral training in cardiology at Stanford University, and in 1988, she received a Doctor of Science (DSc), Medicine, from London University. Dr. Valantine became a Clinical Assistant Professor in the Cardiology Division at Stanford and rose through the academic ranks to become a full Professor of Medicine in the Division of Cardiovascular Medicine and Director of Heart Transplantation Research. She came to the NHLBI in 2014 to continue her research while also serving as the first NIH Chief Officer of Scientific Workforce Diversity. Dr. Valantine has received numerous awards throughout her career including a Best Doctor in America honor in 2002. She has
authored more than 160 primary research articles and reviews and previously served on the editorial boards of the journals Graft and Ethnicity & Disease. Dr. Valantine is a member of the American College of Cardiology, the American Society of Transplant Physicians, and the American Heart Association, and past President of the American Heart Association Western States Affiliate.

**Maria da Graça Vicente, Ph.D.,** is the Charles H. Barré Distinguished Professor of Chemistry at Louisiana State University. She is also the Program Director for the Initiative for Maximizing Student Development (IMSD) Program at LSU, and in 2016 she was named a Distinguished Research Master in Science, Technology, Engineering and Mathematics (STEM) at Louisiana State University. Dr. Vicente is co-author of twelve book chapters, 200 peer-reviewed publications and 4 patents. She has been honored with several awards, including the 2015 LSU Foundation Distinguished Faculty Teaching Award, and most recently a 2016 Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM).

**Elizabeth Watkins, Ph.D.,** is Dean of the Graduate Division, Vice Chancellor of Student Academic Affairs, and Professor of History of Health Sciences at the University of California, San Francisco. She came to UCSF in 2004 and has served as dean since 2012 and as vice chancellor since 2013. As dean, she serves as the chief academic officer for UCSF’s graduate students and postdoctoral scholars. As vice chancellor, she oversees career and professional development, disability services, educational technology services, financial aid, first generation to college support, institutional research, international services, learning resources, registrar, student government, student health and counseling, student information systems, student life, and veterans support.

Watkins earned her B.A. in biology and her Ph.D. in history of science at Harvard. She is the author or co-editor of five books and numerous articles on the history of birth control, sex hormones, and pharmaceuticals. Her work has been funded by NIH, NSF, NEH, and the National Academy of Education.

As dean, Watkins has implemented new programs to build community and to improve the graduate student experience, and she has overseen the establishment and growth of an $80 million endowment for basic science Ph.D. students. Watkins is dedicated to broadening diversity and fostering inclusion in graduate education, and serves as PI on UCSF’s NIGMS IMSD grant. She is very interested in supporting graduate students and postdocs in meaningful career exploration and development, and she co-leads the Coalition for Next Generation Life Science.

**Marenda Wilson-Pham, Ph.D.,** earned her PhD in Microbiology and Molecular Genetics at The University of Texas Graduate School of Biomedical Sciences. In 2013, Dr. Wilson-Pham joined the MD Anderson UTHealth Graduate School (GSBS) Deans’ Office to assist in improving the recruitment and retention rates of underrepresented minority students through retention and bilateral recruitment programming. In 2015, she became the Assistant Dean of Diversity and Alumni Affairs where she was responsible for strategic planning and implementation of diversity and recruitment programs, management and support of student organizations, and alumni engagement and programming. During her time at the GSBS she published two peer-reviewed manuscripts in *CBE Life Sciences Education* titled “Institutional Interventions that Remove Barriers to Recruit and Retain Diverse Biomedical PhD Students” and “A Model for Holistic Review in Graduate Admissions that Decouples the GRE from Race, Ethnicity, and Gender.” Dr. Wilson-Pham is currently the Associate Dean at Rush University Graduate College with a purview over academic affairs, curriculum, and admissions.

**Carrie D. Wolinetz, Ph.D.,** is Associate Director for Science Policy and Director of the Office of Science Policy (OSP) at the National Institutes of Health (NIH). As leader of OSP, she advises the NIH Director on science policy matters of significance to the agency, the research community, and the public, on a wide range of issues including human subjects protections, biosecurity, biosafety, genomic data sharing, regenerative medicine, the organization and management of NIH, and the outputs and values of NIH-funded research. Prior to joining NIH, Dr. Wolinetz worked on biomedical research policy issues as the Deputy Director for Federal Affairs at the Association of American Universities (AAU) and the Director of Scientific Affairs and Public Relations at the Federation of American Societies for Experimental Biology (FASEB). She also served as the President of United for Medical Research, a leading NIH advocacy coalition. Outside of NIH, Dr. Wolinetz teaches as an Adjunct Assistant Professor at Georgetown University in the School of Foreign Service’s program on Science, Technology & International Affairs. She has a BS in animal science from Cornell University, and she received...
her PhD in animal science from The Pennsylvania State University, where her area of research was reproductive physiology.

Henry H. Wortis, M.D., earned his M.D. at Albert Einstein College of Medicine and went on to a medical residency at NYU Bellevue and a rheumatology fellowship at Stanford. Dr. Wortis turned to full time research as a post-doctoral fellow at the National Institute for Medical Research in London. There he developed a technique for identifying individual IgG producing cells, studied the role of T cells in inducing antibody isotype switching and the cellular basis for T cell deficiency in nude mice. During that time, he received mentoring from Sir Peter Medawar, Avrion Mitchison and Len & Lee Herzenberg. When Dr. Wortis established his own laboratory, he began studies of B cell development and the functional defects in mice with mutations of Bruton’s tyrosine kinase and CD22, resulting in immune- deficiency on the one hand and auto-reactivity on the other. Wortis was particularly interested in the development and function of B-1 cells. More recently he turned his attention to a completely new area, the analysis of age- associated loss of resistance to infection. He and his collaborators have pioneered in the use of a genetic approach to analyze this problem.

Dr. Wortis has a major interest in understanding best practices in graduate and post graduate training in biomedical research. He directed an immunology training program for many years in addition to training 13 successful PhDs who are all still engaged in research and served on several study sections concerned with training awards. In addition, Wortis developed the Tufts/Sackler Post-baccalaureate Research Education Program (PREP) and has served as its director since its founding. These interests led him to participate in the national activities of the American Association of Medical Colleges’ Graduate Research Education and Training (GREAT) group. He served as its national chair in 2009. Dr. Wortis retains a strong commitment to training, focused on enhancing the diversity of the biomedical workforce. He is interested in fostering the sharing of best practices in biomedical education and the adaptation of evidence-based teaching approaches.
POSTER SESSION A: Tuesday, July 30, 5:00P - 7:00P

POSTER SESSION B: Wednesday, July 31, 5:30P – 7:00P

POSTER SESSION C: Thursday, August 1, 5:45P – 7:15P

NOTE: All poster presenters may install their posters on their assigned poster board beginning on Tuesday, July 30th at 3:00 p.m. You may leave your posters on the boards throughout the TWD 2019 meeting and the last poster session scheduled on Thursday evening, August 1st.

Posters must be removed from the poster boards following the end of Poster Session C on Thursday evening, August 1st. The poster boards will be removed from the Grand Ballroom Foyer and Salon A on Friday morning, August 2nd.

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Enhancing Capacity to Address Health Disparities: the ASCEND Community-Based Participatory Research (CBPR) Small Grants Initiative

Authors: Gillian Silver, Jummai Apata, Shiva Mehravaran, Payam Sheikhattari

Abstract:

Addressing health disparities has proven to be challenging, as has ensuring equal engagement of academicians and community members in health research projects. The Community-Based Participatory Research (CBPR) Small Grants Initiative provides a mechanism and infrastructure that fosters the collaboration necessary to conduct high-quality and impactful research.

This initiative has been implemented for three years. It has funded small (up to $20,000 each) health related CBPR projects led collaboratively by two co-principal investigators (an academic from Morgan State University and a community stakeholder). There have been three rounds of awards: six awards were approved in the first round, four awards in the second round, and four awards in the third round, for a total of 14 projects.

The CBPR project stakeholders are faculty, undergraduates, and community members, representing a diversity of perspectives and levels of experience. The CBPR program includes establishing a (or working with an established) relationship, conceptualizing the project idea, writing the grant proposal using National Institutes of Health forms, implementing the project and managing the grant, evaluating results, disseminating findings, and, if feasible, sustaining the collaboration/relationship.

A Community-University Advisory Board (CUAB), which includes community stakeholders and representatives from the university, oversees the initiative and makes project award recommendations.

The members of the 14 project teams and the CUAB are the foundation of a learning community, which is fostered by an evaluation plan. The evaluation plan comprises multiple mixed-methods tools that conform to the stages of the program’s conceptual model, adapting material developed by the University of New Mexico Center for Participatory Research Engage for Equity project. We believe that the learning community will improve project-specific outcomes, help with partnership sustainability, share external funding opportunities, and mentor future CBPR researchers.

Acknowledgments: This research received financial support from the National Institute of General Medical Sciences, National Institutes of Health, under award numbers RL5GM118972 and UL1GM118973.
The positive impacts of shadowing experiences on undergraduate students’ career exploration has been well documented in medicine and other health-related fields. However, use of shadowing to introduce students to scientific research careers has not been as thoroughly explored. At Xavier University of Louisiana (Xavier), under the National Institutes of Health’s (NIH) National Institute of General Medical Sciences (NIGMS)-funded Building Infrastructure Leading to Diversity (BUILD) Program, research shadowing has been used make students more aware of the research process and expand their knowledge of and enthusiasm for biomedical careers. The BUILD Program at Xavier, Project Pathways, offers opportunities for students to shadow in Xavier research labs and at local partner institutions. The participants observe undergraduate and graduate research students along with research staff and faculty in labs over a period of several weeks. The benefits to the shadowing students include but are not limited to the opportunity to observe and ask questions about live experiments; and the ability to explore the pros and cons of participating in research and attending graduate school. Participants can also form and benefit from mentoring and near-peer mentoring relationships. Shadowing participants are uniformly positive in their responses to post-shadowing surveys and indicated that shadowing was effective at helping them to understand the research process and clarify their goals as related to research. Graduate student shadowing participants responded in a similar, positive manner overall, and on their intent to apply for graduate school. Overall the assessment results show that research shadowing is a low-cost, high-impact intervention beneficial for large numbers of undergraduate students who are curious about biomedical research careers.
Inculcating a Culture of Research Entrepreneurship: Lessons Learned from the ASCEND Student Research Center

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ASCEND, “A Student-Centered Entrepreneurship Development training model to increase diversity in the biomedical research workforce,” is an NIH BUILD-funded program at Morgan State University, Baltimore, MD. The principal philosophy of ASCEND is that leading scientists have the attributes of entrepreneurs in that they use their creativity to generate novel research ideas, pitch their ideas to secure funding, take ownership of their projects, lead staff and other scientists, are rewarded for their success, and in every step of this venture, they accept the associated risks and responsibilities. Accordingly, ASCEND has designed an Entrepreneurial Training Model (ERTM) which prepares undergraduate students to become leading entrepreneurial scientists by going through four stages: 1) Inspiration, 2) Ideation & Innovation, 3) Implementation, and 4) Growth. To accomplish its goals, ASCEND has established multiple interventions including a student-led organization called the Student Research Center (SRC) where undergraduate students associate with like-minded peers, practice leadership, receive relevant training and mentoring, learn how to develop, implement, and present their own research, and grow through the process. The peer support that students receive through the SRC is particularly relevant to underrepresented minority students who are often disadvantaged by having fewer role models and less peer support in conducting research.

Since its inception in 2016, over 250 students from almost every major and classification have become SRC members. Thus far, 31 student-initiated research concepts have been developed, 13 of which have turned into full project proposals. Compared to a matched control group, SRC members have shown statistically significant improvements in their science identity, science self-efficacy, and academic & personal self-concepts. We will describe the ASCEND ERTM components, rationale, and history, and how it may enhance undergraduate training in biomedical research. We also discuss evaluation methods, possible sustainability solutions, and programmatic challenges.

Morgan State’s ASCEND program is supported by the National Institute of General Medical Sciences, National Institutes of Health, under Award Numbers UL1GM118973, 8RL5GM118972, and 8TL4GM118974.
The BUILD Training Program (BTP) at UMBC seeks to enhance the diversity and retention of promising undergraduate STEM majors and prepare them to pursue careers in biomedical and behavioral research. BTP Trainees serve as exemplars in this investigation, which is focused on piloting and refining interventions to inform the creation of a comprehensive, multidimensional model for a public research university. BTP is one component of the STEM BUILD at UMBC initiative that builds on strategies of established UMBC student training programs (e.g., Meyerhoff Scholars, MARC U*STAR) with emphasis on inclusive excellence, capacity, scalability, and sustainability. First-year students with interests in diversity, no other significant scholarship support, and plans to pursue eligible STEM majors are invited to apply for the BTP opportunity and are selected using randomized control trial methodology. Interventions include multi-year summer bridge experiences; cohort building; first-year residency in the STEM Learning and Living Community; supplemental advising; classroom-based group research experiences; opportunities to develop scientific communication skills; noncredit (badging) curricula to develop research skills and goal planning; and credit-bearing courses to introduce a research university, quantitative reasoning, responsible conduct of research, phage-hunting, and bioanalytical training. Comprehensive evaluation methods, which include periodic surveys, focus groups, interviews, and data analyses, have shown statistically significant differences in STEM major retention rates, cumulative GPAs, and research self-efficacy and science identity levels between BTPs and comparison groups. STEM BUILD outcomes demonstrate the need to focus interventions on the first two years of study when undergraduates are most likely to drop out of STEM majors or the university. Other lessons learned include limiting additional credit requirements by using non-credit practicums to advance knowledge and skills; building community through a STEM living and learning community, developing student decision-making skills through enhanced professional advising, and using classroom-based group research to foster research skills and encourage individual research experiences.
Effective mentorship is critical to the success of early stage investigators, and has been linked to enhanced mentee productivity, self-efficacy, and career satisfaction. The mission of the National Research Mentoring Network (NRMN), in its first five-years, has been to provide all trainees across the biomedical, behavioral, clinical, and social sciences with evidence-based mentorship and professional development programming that emphasizes the benefits and challenges of diversity, inclusivity, and culture within mentoring relationships, and more broadly the research workforce. NRMN has developed and implemented a multifaceted portfolio of programs to enhance national efforts to increase the size, quality, diversity, and research productivity of the biomedical workforce. The goals of these programs combined are to: 1) match and link mentees across career stages to mentors and coaches; 2) train mentors, coaches, and mentees to more effectively navigate and maximize their relationships; 3) refer mentees to career and research resources; and 4) promote the value of career mentoring. Evaluation and outcomes from a broad range of NRMN programs including MyNRMN, MyMentor, research mentor and mentee training, career coaching and intensive grantsmanship coaching will be highlighted. Lessons learned from the first five years of NMRN and future plans including those toward aimed at sustainability will be shared.
IPERT – Poster Board #8

Enhancing Research Training through Empowerment, Resilience, and Civic Engagement

Isar P. Godreau ¹, Raymond Tremblay ², Mariluz Franco-Ortiz ¹ and Margie Álvarez ²

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The UPR – IPERT Program targets undergraduates from a variety of disciplines not traditionally associated with biomedical research and junior faculty from primarily undergraduate institutions within Puerto Rico to increase socioeconomic diversity. The project collaborates with existing groups such as the Yale-CienciaPR network and the NIH-NRMN Program. Key questions the program addresses are: 1) How can more students benefit from biomedical training in PR, especially those who are socio-economically disadvantaged and enrolled in non-traditional Departments? 2) How can they gain competency and credentials in research training when there is a scarcity of research mentors? and 3) How can we create favorable institutional conditions for faculty research mentors and students in the face of economic challenges? Program Activities and strategies developed to address these questions include increasing resilience of students through coaching, increasing mentor to mentee ratio via special research skill courses, promoting the use of web-based research webinars, integrating theater and faculty writing retreats. The poster presentation will showcase some of the most important outcomes of the program so-far, including quantitative and qualitative measures of student success in terms of persistence, graduation rates, but also perseverance, commitment and confidence. The poster will also describe challenges faced by undergraduate students in Puerto Rico as the Island and the Public University (the UPR) in particular is undergoing drastic budget cuts and 200% tuition increase for students, due to severe austerity measures impacting Puerto Rico due to the debt crisis. The poster will outline some of the strategies the UPR- IPERT program has implemented and the adjustments made to address these and other challenges.
SCOARE Project

The SCOARE project is the translational step in an NIGMS-funded research program investigating the role of communication skills in research career development. Our work is grounded in sociolinguistic principles and social cognitive career theory. Evidence from both cross-sectional and national, longitudinal, dyadic surveys of mentors and trainees indicates that trainees’ active engagement in SciComm writing, speaking, and presenting as well as their mentors’ active mentoring of SciComm predict self-efficacy, science identity, outcome expectations, and ultimately, career intention. The SCOARE project translates those findings into a curriculum for research mentors that equips them with awareness of the impact of communication on research career development and techniques for accelerating their mentoring of these skills. The workshop will be offered at four sites per year for five years, study longitudinal outcomes, and train new facilitators to ensure scalability. The curriculum features techniques for mentoring writing, presenting, and everyday speaking. (Speaking in everyday research conversations is shown by our evidence to be as powerful a predictor as writing.) The mentoring techniques were developed specifically to address the operative social-cognitive factors in our model. With the goal of training 500 mentors, the first round of workshops was completed in January 2019. Our site partners at the four national sites assist in recruitment of workshop participants as well as coordinate on site logistics. Participants at various sites have expressed interest in becoming facilitators, and an online resource bank has been created. Both formative (external) and summative evaluation are being conducted. Summative evaluation is conducted through pre- and post-dyadic outcomes surveys of both participant mentors and their trainees. Formative evaluation results were enthusiastic and expressed need for more hands-on strategies and time to integrate strategies into personal plans. Post-workshop survey data is being collected as of this writing.
The Impact of a Multi-Institutional Collaboration that Provides Mentorship at the Critical Transitions

Medeva Ghee, William Wittels, Carrie Spearin, Chloe Poston, Brian M. Lawrence, Mentewab Ayalew, Kimberly Jackson, Regina Dixon-Reeves, Nancy Schwartz, and Don C. Brunson.

The Leadership Alliance, Brown University, Providence, RI; Department of Chemistry, Morehouse College, Atlanta, GA; Department of Biology, Spelman College, Atlanta, GA; Department of Chemistry and Biochemistry, Spelman College, Atlanta, GA; Office of the Provost, University of Chicago, Chicago, IL; Department of Pediatrics, Department of Biochemistry and Molecular Biology, University of Chicago, Chicago, IL; Graduate School, Vanderbilt University, Nashville, TN.

To increase underrepresented scholars’ readiness for and success in the research workforce, the Leadership Alliance has developed programming at each stage of the academic pathway. Informed by social cognitive career theory (Lent et al., 1994), we propose that interventions at each transition results in positive changes in trainees’ plans to pursue doctoral programs and knowledge of research careers. Through a collaboration between Brown University, Morehouse College, Spelman College, University of Chicago, and Vanderbilt University, we developed and implemented training activities at the critical transitions starting with workshops for first-year undergraduates titled Creating a Collaborative Learning Group and What is Research? The Collaborative Learning workshop showed significant gains in students’ skills (69% pre- and 94% postsurvey; p<0.05) and confidence (53% pre- and 88% post-survey; p<0.01) in starting a collaborative learning group. We observed a statistically significant increase in interest in research careers from students who participated in the What is Research workshop.

For predoctoral and postdoctoral scholars, our Career Development Workshop showed an increase from 34% (pre-survey) to 85% (post-survey) in respondents who indicated a clear understanding of non-academic careers available in their discipline. Pre and post-surveys further showed an increase from 15% to 95% for how to market themselves for non-academic careers and an increase from 34% to 89% for academic careers.

At the faculty level, grant writing coaching groups provide an opportunity for junior faculty from Minority-Serving Institutions to develop proposals that support their research. Three of the five faculty who participated had successful proposals. Our results collectively provide evidence of effective, longitudinal interventions that increase trainees’ self-efficacy and competitiveness as they progress through the academic pathway.

This project is supported by an IPERT award R25GM125707.

Reference:
Enabling NextGen Advanced Biomedical Leadership (ENABL) via Immersive Training Experiences at Cold Spring Harbor Laboratory

Charla Lambert¹ and David Stewart¹

¹Cold Spring Harbor Laboratory Meetings & Courses Program, Cold Spring Harbor NY

Practicing scientists, from graduate students and research technicians to tenured independent investigators, often must learn new techniques, paradigms, or even entire subfields as part of their continuing research programs. This need can arise, for example, from rapid advances in experimental technology or a move toward interdisciplinary research questions. When faced with such a need, many scientists learn the new techniques piecemeal from different research groups and centers at their home institutions, a process that can take months. Cold Spring Harbor Laboratory’s ENABL program is a cohesive set of advanced research training experiences and ancillary resources that allow practicing scientists to become rapidly and efficiently immersed in a new set of concepts and techniques. The training is composed of in-residence short courses and workshops aimed at graduate students, postdoctoral scholars, and early-career independent investigators. Four of the courses develop laboratory and scientific skills in specific subfields of biomedical research: Antibody Engineering & Phage Display, Single Cell Analysis, Synthetic Biology, and Metabolomics. Two of the courses are focused more on “soft skills” that are needed to succeed in independent research across all fields in biology: the Workshop Leadership in Bioscience and the Scientific Writing Retreat. Each course or workshop is taught by a team of experts who update the curriculum annually in response to new technologies and approaches as well as to evaluation survey responses. The ENABL program also has significant components in dissemination, mentorship, and alumni community building, with the goal of strengthening the professional relationships and networks formed while the courses are in session. Past trainees have credited ENABL courses and workshops with teaching them new scientific skills, stimulating new research directions, and fostering new long-term collaborations, research fellowship opportunities, and mentoring relationships.
ADVANCE: A Transition Program to Graduate School

Bryan Thomas Jr.\textsuperscript{1}, Anthony J. Ricci\textsuperscript{1} PhD

\textsuperscript{1}Stanford University

Having a sense of belonging increases confidence and performance for students, particularly for those students with imposter syndrome during their academic training. Our mission is to help combat imposter syndrome and other systemic barriers to student success by creating a program that not only recruits and retains students, but also works on developing their personal and multiple identities. Thus, to address this challenge, we created ADVANCE as a holistic development model for underrepresented populations (urp) in the Biosciences. ADVANCE serves as a recruitment and yearlong retention program aimed at increasing the URP population in the Biosciences as well as enhancing a sense of belonging within the Biosciences community. Since the creation of ADVANCE, we’ve seen an increase in the URM population across the Biosciences as well as a greater sense of belonging and satisfaction amongst students.

Programmatically, ADVANCE has three pillars for student development. Academic, professional development, and community building. These pillars are implemented within the summer component of ADVANCE as well the academic sector.

During the summer, students participate in an 8-week transitional program in which they participate in workshops, social events, network with faculty, and participate in a summer lab rotation, journal club and writing workshop series. During the academic year, students participate in lightening talks, which serves as a mock qualifying exam, movie nights in the school of medicine lounge, and outreach activities both locally, virtually, and nationally.

The directors will highlight program details of ADVANCE as well as best practices developed over the past 5 years and also opportunities for growth.
Management Matters for Scientists

Fanuel Muindi¹, Uma Karmarkar², and Catherine Dulac¹

¹ Molecules, Cells, and Organisms PhD Training Program, Department of Molecular and Cellular Biology, Harvard University; ² Marketing Unit, Harvard Business School

Motivation: Young investigators running independent labs in today’s scientific market face many obstacles. In addition to writing proposals, publishing papers, teaching and service to their school/field, they are also faced with the day to day business of running a lab. More than ever, an understanding of how to lead a lab as a successful organization is essential for young investigators' career and productivity.

Approach: In collaboration with faculty members of the MCO program and Harvard Business School (HBS), we designed an interactive nanocourse called “Management Matters” to cover the following: basic elements of business strategy (Module 1), improving leadership, teamwork, and team management (Module 2), developing effective science communication skills (Module 3), and gaining a deeper understanding of research management and practice in industry through field trips (Module 4).

Outcomes: The 4 modules were scheduled to take place throughout the academic year. We measured the effectiveness of each of the training modules through a detailed evaluation via an online survey instrument. Overall, students found Module 1 very useful and expressed satisfaction with the in-class case study, effectiveness of the instructor, and duration of the module (3-hrs). Module 3 was held in two separate sessions. The long duration and instructor dynamics presented a challenge to some of the students in session 1 (science writing). However, many of the components (duration, in-class assignments, instructor) in session 2 which covered science presentation skills was well received by students. So far, we are finding students are reasonably able to articulate important take-away lessons from each of the modules. Modules 2 and 4 are still in progress.

Sustainability: In order to accommodate more students to attend these important workshops and sustain it in the long run, our plan is to offer a half-day management matters mini conference each year comprised of interactive workshops that would cover important topics in the area.
Evaluation of PhD Student Training in the Biological and Biomedical Sciences

Jennifer Claydon¹,⁵, Philip Reeves¹, Susan Baserga²,³,⁴, John Alvaro⁴, Anthony Koleske²,⁵,⁶

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National funding agencies have been calling for reform of graduate STEM education, and the National Institute of General Medical Sciences (NIGMS) now requires competency-based evaluation plans that assess a well-defined training mission using evidence-based practices. In response to the NIGMS’s new predoctoral training grant application (PAR-17-341) the Biological and Biomedical Sciences (BBS) Program at Yale sought to conduct a comprehensive evaluation of its curriculum and training activities. We focused on four departments (Cell Biology, Genetics, Molecular Biophysics & Biochemistry, Molecular, Cellular and Developmental Biology) that will be part of the new Cellular, Molecular and Quantitative Biology Training (CMQB) Program. Over the course of a year, an assessment team met with department stakeholders to collaboratively design an evaluation plan using the Systems Evaluation Protocol (SEP). SEP was developed in 2012 by the Cornell Office for Research on Evaluation and is a standardized procedure providing an evidence-based, innovative methodology for assessing multifaceted programs. Here we describe the evaluation process used during academic year 2018-2019, and portray the outcomes of the modeling on the CMQB program. The assessment process included developing an evaluation plan, building both a logic and a pathway model, identifying gaps in various areas of content delivery and how student learning objectives were being measured, revising existing measurement instruments, generating new surveys to assess trainers and trainees, updating the program’s mission and objectives, and identifying processes for continuous improvement. This evaluation process can be used as a framework by other programs to help them conduct evaluations of their own graduate training programs. We will discuss implementation of the new survey tools that were developed for graduate training, and review some of the challenges we encountered in gaining faculty buy-in. Future work includes determining how best to use the data that we will collect to continuously improve the CMQB training program.

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https://www.nap.edu/catalog/25038/graduate-stem-education-for-the-21st-century

Biomedical PhD graduates are pursuing career avenues outside of academia at the highest rate in recent decades. The National Institute of General Medical Sciences offered supplemental funding to T32 predoctoral training grants to expose graduate students to a myriad of biomedical career opportunities, and in 2017, Yale’s Combined Program for the Biological and Biomedical Sciences (BBS), first offered a course on ‘Skills Development for Diverse Scientific Careers.’ This semester-long course is currently running for the second time and addresses career-related topics not covered in any curriculum at Yale: how to run clinical trials both in academia and in pharma; the business and scientific sides of biotech; strategies for optimal professional productivity; how to convert a CV into a resume; and resilience for early career scientists. To assess the impact of the course and whether students are mastering the learning outcomes, a pre- and post-test design is being implemented using Qualtrics. The surveys ask students about their scientific identity development, their current level of confidence in knowing what career options are available, confidence in succeeding in various careers they could pursue, and agreement ratings along various career pathways they are currently interested in investigating (Anderson, 2016; Sinche, 2017). The surveys also address their perceived levels of support from faculty advisors in exploring various career pathways, and whether the course content helped them to identify next steps in their career planning process (Furhmann, 2011; St. Clair, 2017). Finally, we will ask about additional content students want exposure to and any changes they would implement the next time the course runs. This course seeks to encourage students to think broadly about their career options by exposing them to non-traditional biomedical career avenues, and fulfills a gap in current curricular offerings to help prepare students for multiple biomedical science career trajectories.

Sponsored by: Administrative supplement to T32GM007223 and the BBS.

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In an environment where professional development is frequently seen as ‘extracurricular’ or ‘extraneous’, it is important for training programs to articulate that effective and successful academic communications includes technical, operational, and interpersonal elements for which graduate students are not formally trained. To that end, we designed a workshop for third year students to address the complicated phase of their training when intellectual, social, and emotional competencies are being challenged. At this point in their career they have begun to present their research at journal clubs, poster sessions, and conferences; they are also beginning to build their professional network and likely to be navigating career-related conversations with advisors and negotiating complex lab relationships. The content of the workshop focused on: 1) clear and confident presentation of posters, slides, and research talks to scientific audiences, and 2) conducting difficult conversations with advisors and peers, including issues of rigor and reproducibility, conflict resolution within the lab environment, and career trajectory.

The workshop was delivered by NIGMS training grant directors and professional development specialists. The course consisted of ten, 1.5-hour group sessions, including two sessions where participants were recorded presenting short scientific talks based on their own research project. Faculty presented sessions related to technical communication of scientific content (slide, poster, and research talk design), while sessions related to interpersonal communications and presentation anxiety were led by staff trained in conflict resolution and career development. Small group work and roleplaying exercises required trainees from dissimilar scientific specializations and cultural backgrounds to engage in discussion and scientific analysis of each other’s scientific content, thereby broadening each trainee’s understanding of disciplines beyond their own. Each session was evaluated by post-event survey, culminating in a final course evaluation discussion that queried the participants’ overall experience of the course and gathered their recommendations for refinement.

General topic: Focusing on Technical, Operational, and Professional Skills Development
Professional Preparedness in Biotechnology

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The NIGMS aspires to “provide leadership in training the next generation of scientists.” Although current courses in the typical graduate curriculum deliver strategic discipline-based learning for life science and engineering students, the broader biotech and health science industry further demands that scientists be prepared to serve a variety of distinct functions and to understand broader developmental aspects of the business of science and engineering in a professional environment. Many scientists, while experts in their respective fields, have little academic/professional background in business management; i.e. skills that ensure that scientific projects and research are implementable, feasible and sustainable. A T32 supplement through the NIGMS/NIH TWD mechanism allowed us to establish a graduate course entitled, “Professional Preparedness in Biotechnology,” providing practical and professional context and available to a diverse group of students enrolled in various NIH, NSF and DOE programs focused in biotechnology and life sciences. The course works to enhance students’ competitive skills and introduce additional layers of specialized competence enabling immediate contribution within diverse organizations in the biomedical sciences commercial sector. The course is taught by experts in the fields of communications, business management, financial analysis, quality assurance and process management. The syllabus combines didactic instruction with expository case studies, reinforcing key learning as students review and analyze case studies specific to various professional environments and challenges, and present recommendations to the class to seed group discussions and further role-play. At the end of the semester, students present a case study based upon their area of professional interest with analysis of the actions and inactions relative to the concepts taught in class. The course is offered as a permanent component of the Biomedical Engineering and Chemical & Biochemical Engineering graduate programs and, launched in the summer session of 2017, resumes again in summer 2019 with 10-15 students per offering year.
Developing Professional and Technical Skills for Diverse Career Paths in Biomolecular Pharmacology

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Breathtaking technological advances are rapidly altering the breadth and scope of pharmacology and experimental therapeutics as a research discipline. While the fundamentals of pharmacology have largely remained unchanged, the technologies used in preclinical drug discovery and translational pharmacology have advanced dramatically. Our knowledgebase has expanded with computer modeling, imaging, optogenetics, and many other technologies that are creating permanent changes in the investigational landscape. Next Generation Sequencing (NGS), bioinformatics, neural circuitry, and neural network analysis have enabled a deeper mechanistic understanding of the molecular mechanisms of disease progression in the fields of cancer, cardiovascular and neuroscience research. These advances have led to the development of next generation therapeutics. Consequently, doctoral students in pharmacology must familiarize themselves with an array of techniques. To publish their research in high impact journals and obtain research funding, students must be trained in effective writing and communication skills. To receive strong foundational training and enhance their core technical and professional skills, we propose curricular and administrative revisions to strengthen and enhance our NIGMS T32 Training Program. The overarching goal is to effectively train the next generation of research pharmacologists and to address the gap in skills development that currently exists in pharmacology training programs. As a centerpiece for the revisions, we will develop a new course, Technical and Professional Skills in Pharmacology (TPSP). This course will comprise three independent modules. Module I covers scientific writing and requisite skill sets for students to publish first-authored original research articles. Module II covers experimental design and effective writing of research proposals. Lastly, Module III covers in-depth instruction in computational skills needed to conduct cutting-edge research in pharmacology. Taken together, the new course will provide a broad and holistic educational experience for trainees in the T32 program. Curricular changes will be integrated with ongoing initiatives spearheaded by the BU BEST program. Outcomes will be shared on a national level with both the Graduate Career Consortium and the AAAMC Great Group as a way to share best practices.
The Development of a New Course titled: Rigorous and Reproducible Design and Data Analysis

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This new course was developed in response to PA-16-060 with the two goals of teaching students in all aspects of life sciences how to computationally analyze datasets and to inculcate best lab practices in experimental design and analysis. Students will learn the computer language R, and use R to analyze datasets from transcriptome, genome, and clinical studies. Students will develop an understanding of sources of bias and the impact of these biases on results and potential conclusions. Examples will be taken from the literature of experimental designs that were rigorous and from examples that had built-in flaws. At the completion of the course, students will have an intermediate level of competency in R and knowledge of how to manage and analyze large datasets. This course has been offered twice in the spring semester, and it will be offered again in the spring of 2020. In the first two years, there were 16 students enrolled in each class. The design was to provide in class opportunities in multiple types of datasets including transcriptomes, genomes, and de-identified clinical data. Different groups of students would analyze the data using different bases of assumptions and compare how results changed. In practice, we were over-ambitious in the number of types of datasets, and we did not need to set different assumptions since analytic programs were highly dependent on setting parameters that were in practice arbitrary and resulting analyses by students were frequently divergent. The in-class datasets in combination with lecture material that outlined each paper as a case-study was successful in developing the desired analytic skills. A lecture on best practices in the wet lab will be expanded in the next offering in the course and will hopefully expand interest in the course among students with lower computational proficiency.
A Pilot Program to Assess Burnout and Enhance Resilience and Grit in MSTP Students.

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Penn State College of Medicine

Learning Objectives:

- Assess burnout and consider the relationship with the character trait, grit, in MSTP students
- Describe interventions to promote knowledge of and decrease incidence of burnout as well as increased wellness and sense of community.

Medical students, residents, and academic physicians are experiencing higher rates of burnout and dissatisfaction with their careers than ever before. We received an Administrative Supplement to our NIGMS T32 MSTP to develop and implement training to promote resilience, grit, wellness, and a stronger sense of community among our trainees. To achieve this goal, we implemented several new whole group sessions in the context of two additional 1-day retreats and three 1.5 hour evening sessions within the existing professional development curriculum. To assess the intervention, the Copenhagen Burnout Inventory (CBI), Grit Scale, and program evaluations were administered. Electronic surveys collected the validated scales, program evaluation data, level of training, and sex. Responses were anonymous. This study was exempted by the Penn State IRB. The CBI survey was distributed in September 2018 and May 2019, the Grit Scale and program evaluation was administered in May 2019. Descriptive statistics and comparisons of proportions and means were conducted. Overall, 58/58 students responded to at least one of the three surveys (100%), and 31/58 students responded to the CBI survey at both time-points (53.45%). Personal burnout rates were higher for females (p=.007) and trended toward highest for G3/4/5 (p=0.10-0.15). As only 1/31 students responding to the Grit Scale survey scored ≤3, there was no comparison made between the Grit and CBI surveys. Qualitative analysis of program evaluations elucidated important themes including: the need to establish buy-in from students and faculty; the positive role of the sessions in supporting ‘Community’; the need to focus on all aspects of burnout; and the desire for educational methods (e.g. transformative, social cognitive, adult learning theories) that are aligned with explicit goals. The knowledge and skills necessary to support resilience and grit are crucial to facilitate success among our MSTP students and build sustainability in their careers as physician scientists.
A Comprehensive Approach to Graduate Training with Integration of Professional Coaching

Steven K. Wendell, Michael J. Forlenza, Patrick J. Pagano

Many creative initiatives continue to be explored for their potential to transform and optimize graduate training. The University of Pittsburgh has a history of developing a variety of individual training components including some based on the underpinnings of International Coach Federation (ICF) accredited professional coaching. While there have been successes with these components in isolation, greater potential may be realized if these components were modified, combined and coordinated. The predoctoral, Pharmacological Sciences Training Program (PSTP), as an early adopter of prior initiatives, is employing this comprehensive training approach with the support of a T32 supplemental award. (T32GM008424-23)

We created a comprehensive graduate training program that incorporates modifications based on our prior experiences and informed by career development theories and coaching models from a broad disciplinary spectrum that would be re-enforced with scholars and mentors across all components.

The primary components include:

- Graduate credit career course (required) - *Foundations of Successful Career Planning and Development* supported with one-on-one professional career development coaching for scholars;
- Mentor training – Core coaching skills to expand their mentoring toolkit and a summary of the critical content that scholars receive in the career course. Supported with one-on-one professional coaching for mentors;
- Career Development Plan (CDP), Annual Self-Assessment, Annual Progress Assessment – modifications of forms and processes to align with the content of the graduate career course;
- Mentor Meeting Reflection Form – An online form for scholars to complete after mentor meetings that is automatically emailed to the scholar and mentor to support clarification of shared understanding, reflection on action items in relation to the parent CDP, re-enforcing concepts such as SDT.

Outcomes data including the Career Adapt-Ability Scale (CAAS) and Mentoring Competency Assessment (MCA) will be presented.
We developed the new course “Quantitative Measurement and Analysis”, now a compulsory course for first year Systems Biology Graduate students, and open to all Harvard graduate students. The mission of this course is to impart students with core principles for building an assay, characterizing its performance, and obtaining reproducible and statistically significant results. We believe this training will impact the students’ quality as scientists, and make them better science citizens with the ability to understand and identify assumptions in published data. The course was developed to contain 3 modules: (1) a statistics module that culminates in topics of error propagation, multiple hypothesis testing and an introduction to high-dimensional data analysis, with exercise-driven learning. (2) A biophysics module that introduces physicochemical limits of measurement. (3) An ‘Applications’ module that applies principles from the first two modules to modern techniques. In a final exercise, students analyze an unsolved problem in biological measurement.

The course has run for three years, and we have received consistent positive feedback on the Statistics module, but that the remainder of the class is too hard for some students while too easy for other students. This feedback reflects the diversity of our Systems Biology Graduate Program, which recruits students from biochemistry to pure mathematics. We are now redefining the course as follows: we will partition the class into two halves, a first half being a compulsory statistics course that will cover current topics including estimators, important distributions, error propagation, multiple hypothesis testing, and p-hacking. This will be followed by an optional course aimed at mathematically-minded biologists. Topics will include high-dimensional data analysis, machine learning, and conclude with examples of how biological systems themselves carry out measurements in the face of molecular noise, providing a link between biological systems and the study of measurement and reproducibility.
Doubled Rate of Participation in Mentored Undergraduate Research by Students Who Completed an Alternative, Cross-disciplinary Freshman Laboratory Course

David Julian

Department of Biology, University of Florida

The Cross-Disciplinary Laboratory (X-Lab) program at UF was created to 1) help students develop a synthetic, cross-disciplinary approach to understanding the natural sciences; and 2) provide students with the key theoretical and practical skills necessary to confidently engage in life sciences research as early undergraduates. The X-Lab program is a two-semester alternative to the traditional laboratory courses in general biology, chemistry, and physics, and is now available to all STEM majors at UF. Students who completed the X-Lab program (n=707, "X-Lab students") were compared to UF students from the same majors who completed the traditional laboratory courses in the same years (n=19,314, "control students"). The key measured outcome was whether each student later participated in mentored undergraduate research, as identified by them registering for research as an elective credit in their major. Compared to control students, more X-Lab students identified as Asian (1.3x), Black (1.2x, not sig.), Hispanic (1.1x, not sig.), and fewer identified as White (0.83x) and male (0.82x). We found that X-Lab students were 2.8x as likely to participate in research compared to control students (56% vs. 20%). This effect was significant regardless of race/ethnicity and gender, although the magnitude of the effect on research participation varied (2.5x for Asian, 2.7x for Black, 2.2x for Hispanic, 3.2x for White, 2.5x for females, and 3.2x for males). The control students and X-Lab students were otherwise similar, based on AP scores and math preparedness, and their grades in the "lecture" courses in general biology, chemistry, and physics were comparable. Although the X-Lab students were self-selected (i.e., this was not a randomized design), the results indicate that integration of a research skills approach to into the freshman laboratory courses may significantly increase the probability of students seeking out mentored undergraduate research experiences in their subsequent undergraduate years.
Facilitating the Development of Science Communication Skills in a Group of MARC U*STAR Trainees

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¹School of Natural and Social Sciences, Purchase College—SUNY

Science communication is key to student success in STEM. However, it is not a significant component of traditional undergraduate STEM curricula. This gap in STEM education may have a disproportionate negative impact on students with limited access to extracurricular resources to improve their science communication skills. Here we describe efforts to address this gap at Purchase College, SUNY. Over the course of two semesters, we engaged a group of MARC U*STAR trainees in activities centered on scientific reading, data interpretation, writing, and oral communication. Activities focused on (1) reading scientific papers; (2) interpreting published data; (3) writing abstracts; (4) creating posters; (5) giving oral presentations; and (6) writing personal statements for summer research and PhD programs. Despite their overall strong academic backgrounds (mean GPA >3.5), trainees' skill levels in these six areas varied widely at the beginning of the first semester. However, trainees showed marked improvement over the course of two semesters, especially in the areas of writing and oral presentations. This suggests that (1) academic performance in traditional STEM curricula is a poor predictor of science communication ability and (2) there is a need for extracurricular support for science communication skills development at the undergraduate level.
Recruitment of High-Achieving Native American Students to an NIH-MARC U-STAR Program

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At Fort Lewis College, over 38% of students are Native American representing 173 American Indian tribes and Native Alaskan villages. Although the population of Native American students eligible for our campus NIH-MARC U-STAR program is potentially high, the number of applications from qualified and high-achieving students to the program have been historically low. To increase the number of potential applicants to the program, we have instituted several program initiatives to accomplish the following goals: 1) raise the campus profile of the MARC Program; 2) motivate and encourage students to pursue a career path in biomedical research; and 3) provide support and mentoring of potential MARC scholars to increase their competitiveness for a successful application. Some effective initiatives and programs include annual attendance at the SACNAS National Meeting by our Native American students and program director, recruitment of motivated and dedicated MARC Faculty Mentors, an annual poster presentation and symposium featuring current and potential MARC scholars, and campus visits and seminars from prominent Native American scholars. In 2019, we had a record number of applications from Native American students and our current cohort of 6 MARC scholars all self-identify as Native American. Several years of student surveys by our external evaluator indicate that our students feel supported, encouraged, and empowered by their experience as MARC scholars. We have also learned that many of our Native American students face unique cultural challenges that may require additional support to ensure a positive experience as a MARC scholar. Our sustained efforts have led to successful matriculation by our graduating MARC scholars to top graduate programs in the biomedical sciences. The current and sustained achievements of our MARC scholars will allow us to continue to encourage and recruit outstanding Native American students to apply to become a MARC scholar.
Facilitating PREP Post-baccalaureate and IMSD Pre-doctoral Near-peer Student Interactions: Lessons Learned

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¹College of Graduate Studies, Medical University of South Carolina, Charleston, SC

The Medical University of South Carolina is an academic medical center with a total average PhD in Biomedical Sciences enrollment of 180 students. Our pre-doctoral IMSD program has been active for 15 years, with a strong record of increasing PhD attainment rates among underrepresented groups. When designing our post-baccalaureate research education program (PREP) five years ago we sought to bring benefit to both programs by designing activities in which the two groups of scholars would interact. Our initial approach was to include PREP scholars as peers in all IMSD professional development monthly meetings, and to appoint an IMSD scholar to our PREP Steering Committee. We expected PREP Scholars to benefit from the simulation of a first-year graduate school experience by participating in events with near peers, and the IMSD scholars to benefit from the opportunity to mentor PREP scholars, thereby increasing their self-confidence¹,². In subsequent years we introduced structured peer pairing. Outcomes were determined by survey, focus groups, participation rates, and faculty observation. IMSD scholars who served on the PREP Steering committee were active and involved members. IMSD students also actively engaged in activities where they provided input to PREP scholars as they prepared for presentations. However, joint IMSD-PREP group activities did not result in the expected benefits. Structured mentor-mentee events were more effective. Lessons learned: Proximity and group activities alone did not appear to foster beneficial interactions or confidence building. Both post-bac and pre-doctoral scholars reported and/or appeared to have more benefit from structured activities with defined mentor-mentee roles and assignments. Scholars in both programs also benefited from group meetings focused solely on the individual programs.

References:


Student Success Driven by a Summer Enrichment Program for the Pathways to Advanced Degrees in the Life Sciences

Benjamin L. Clarke¹

¹University of Minnesota, Duluth

The Pathways to Advanced Degrees in the Life Sciences promotes research careers to undergraduate students. Three schools participated in PADLS (2009-2019): the University of Minnesota Duluth granting the BA/BS, partnering with two AA granting institutions: Lake Superior College (Duluth MN) and Fond du Lac Tribal and Community College (Cloquet MN). Students from northern Minnesota comprise a mix of low-income, first generation, Native American, African American and Hispanic/Latino students coming from small urban and rural communities. Students entered a 2-4 year pipeline to obtain baccalaureate degrees. Participation in a 10-week academic enrichment program provided seamless entry into UMD research laboratories at the Medical School, Swenson College of Science and Engineering, and the Natural Resources Research Institute. Program core curricula included team-science projects, a book club, and workshops on problem-based learning called critical concepts, student success presented by an Educational Psychologist, public speaking, and responsible conduct in research. These activities were designed to 1) promote collaboration and refine bench skills; 2) enhance reading comprehension; 3) learn hypothesis building and prioritizing ideas; 4) develop professionalism; 5) hone communication and debating skills, and 6) practice ethical norms in their careers. University faculty and post-doctoral fellows gave presentations on research and career paths. Trainees presented articles from potential research faculty-mentor in a journal club. Participants comprised 51 from community college in a Bridges to the Baccalaureate, and 60 university students in a Baccalaureate IMSD. The Bridges Program graduated 43 students with an AA and the Pathways Program (IMSD) graduated 49 students with a BA/BS. Outcomes for training was 17 MS, 18 PhD and 12 in professional degrees of pharmacy, medicine, nursing, education and law. The application of active learning methods generated student confidence, promoted perseverance to sustain their academic progress, and inspiration to proceed into advanced degrees and research careers.
Northern Arizona University Bridging Arizona Native American Students to Bachelor's Degrees

Jani Ingram

Native Americans are the most underrepresented ethnic group in biomedical and health sciences. According to the National Center for Education Statistic (NCES), the overall percentage of baccalaureate degrees obtained by American Indian/Alaskan Native undergraduates is 16% compared to 42% of White students. Additionally, of the bachelor’s degrees awarded in 2015-16, the percentage of degrees awarded in the Biological & Biomedical Science field for American Indians was 5%. The objective of the Northern Arizona University Bridging Arizona Native American Students to Bachelor's Degrees is to increase the transfer of Native American students from accredited 2-year degree granting institutions with historically high Native American student enrollments to baccalaureate degree programs in biomedical and behavioral sciences with the ultimate goal to assist these students in attaining their baccalaureate degrees. The program is centered on a summer research experience for Native American students from Coconino Community College (a community college located in Flagstaff) and students recruited from the Maricopa Community Colleges in Phoenix, AZ. During the past six years, the program has supported 42 Native American students; of these 20 students have transferred to NAU or other 4-year institutions with six students earning a bachelor’s degree. The program combines a summer program for the students to participate in a faculty mentored research experience as well as enrolling in HS 299, a three-credit course focused on science communication. Additionally, the program offers workshops throughout the summer on topics ranging from transferring to NAU, resume development, and research training opportunities at NAU. During the academic year, research and professional development is provided to Bridges alumni at CCC. The evaluation findings from the past funding cycle have identified key areas where our program can be strengthened; these will be described in the presentation.
Group Mentoring at a Distance: Videoconferencing to Promote Deaf Scholar Resilience, Persistence, Retention, and Success

Peter C. Hauser¹, Jessica Cuculick¹, and Steve Barnett²

¹National Technical Institute for the Deaf/Rochester Institute of Technology, and ²School of Medicine and Dentistry/University of Rochester

**Motivation:** Aspiring Deaf and hard-of-hearing (DHH) scientists often navigate biomedical doctoral training in programs that do not provide DHH peers and role models. This experience can be lonely and frustrating and can negatively impact scholar resilience, persistence, retention, and success. Many Rochester Bridges to the Doctorate (RB2D) alumni have matriculated to biomedical science doctoral programs and found it difficult to thrive as the sole DHH student.

**Approach:** To address the lack of a critical mass of DHH scholars at different universities, the RB2D program has developed a virtual community (Deaf Scientist Time-DST). RB2D scholars, alumni, and DHH students from other universities videoconference monthly. The video modality is essential for visual communication (e.g., sign language) amongst DHH participants, and also promotes interpersonal connections. DHH faculty facilitate the meetings, which begin with a check-in to see how the scholars are doing and to address any urgent challenges. Each meeting has an additional specific goal, such as allowing participants to practice conference presentations for feedback, or learning effective survival strategies from more seasoned deaf scientists.

**Outcomes:** The first meeting included 10 DHH participants from five different sites. Participants shared that they are thrilled this resource is available and have excitedly offered potential topics for future meetings. We plan mixed methods (survey and interviews) to assess this new program and inform improvements. We believe that as more DHH scholars learn about this open virtual meeting, there will be greater participation and ultimately a critical mass of DHH aspiring scientists to network and support each other.

**Lessons Learned:** This virtual community was enthusiastically received by DHH participants, and is a promising approach to address isolation, promote community building, and foster persistence and success. This model likely has applications with other groups that are underrepresented in biomedical research fields.
IMSD – Poster Board #79

Training Effective Undergraduate Peer Mentors: An Intervention to Increase Student Success among UR STEM Mentees while Providing Significant Benefits to Mentors

Brian Booton¹, Mark Hannink¹, and Linda Blockus¹

¹University of Missouri-Columbia

This poster will outline an effective peer mentoring model for the mentorship of UR undergraduate STEM majors participating in the University of Missouri's NIGMS IMSD program. This innovative peer mentoring program has resulted in the growth and success of our IMSD trainees, as well as yielding significant learning outcomes for the peer mentors. In the past ten years, our program has grown from 20 to 80 participants. We utilize a cadre of eight trained upper-class peer mentors who meet weekly with our approximately 60 incoming freshmen, sophomores and transfer participants. The specifics of the peer mentor training will be discussed including selection, responsibilities, a three-day training retreat, and 30 weeks of on-going weekly professional development workshops. Our peer mentors assist mentees with acclimating to the university, achieving academic success, identifying and interviewing for research lab positions, as well as maximizing one’s undergraduate research experience. Developing the desired competencies and skills needed for this role requires strategic training exercises and ongoing preparation to boost the Peer Mentors’ effectiveness. Training workshops have been curated and developed that focus on personal reflection and listening skills, as well as employing best practices when advising and coaching students. Peer mentors also participate in our comprehensive IMSD program that integrates research, faculty mentoring, academic and social support, and professional development to prepare students to matriculate into graduate doctoral and medical/doctoral programs. Evidence of this successful intervention has been shown in focus group and external evaluator reports, student feedback, and success of our students entering summer research and graduate programs. With limited funding available to support professional program staff and varying demands of faculty at a research university, we have honed the peer mentor training to expand, strengthen, and enhance our IMSD program, while making the professional development aspect a defining leadership experience for the peer mentors.

References:


Facilitating PREP Post-baccalaureate and IMSD Pre-doctoral Near-peer Student Interactions: Lessons Learned

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The Medical University of South Carolina is an academic medical center with a total average PhD in Biomedical Sciences enrollment of 180 students. Our pre-doctoral IMSD program has been active for 15 years, with a strong record of increasing PhD attainment rates among underrepresented groups. When designing our post-baccalaureate research education program (PREP) five years ago we sought to bring benefit to both programs by designing activities in which the two groups of scholars would interact. Our initial approach was to include PREP scholars as peers in all IMSD professional development monthly meetings, and to appoint an IMSD scholar to our PREP Steering Committee. We expected PREP Scholars to benefit from the simulation of a first-year graduate school experience by participating in events with near peers, and the IMSD scholars to benefit from the opportunity to mentor PREP scholars, thereby increasing their self-confidence¹,². In subsequent years we introduced structured peer pairing. Outcomes were determined by survey, focus groups, participation rates, and faculty observation. IMSD scholars who served on the PREP Steering committee were active and involved members. IMSD students also actively engaged in activities where they provided input to PREP scholars as they prepared for presentations. However, joint IMSD-PREP group activities did not result in the expected benefits. Structured mentor-mentee events were more effective. Lessons learned: Proximity and group activities alone did not appear to foster beneficial interactions or confidence building. Both post-bac and pre-doctoral scholars reported and/or appeared to have more benefit from structured activities with defined mentor-mentee roles and assignments. Scholars in both programs also benefited from group meetings focused solely on the individual programs.

References:


Effective mentorship can promote increased self-efficacy and productivity. These attributes are necessary for the retention of students underrepresented in science and medicine to diversify the biomedical workforce. However, professional development to improve mentoring skills is not always available to those who would most benefit. Graduate students and postdoctoral trainees are routinely assigned to supervise PREP and IMSD trainees. Although mentor training is open to faculty at Baylor College of Medicine, there is no institutional guidance or training provided for trainee members assigned to mentor new members in a lab. To meet this need, we offered NRMN (National Research Mentoring Network) mentor training to the 2018-2019 cohort of PREP and IMSD peer mentors. We provided six training modules in two 2-hour workshops—Maintaining Effective Communication, Aligning Expectations, and Assessing Understanding in the Fall, and Promoting Self-Efficacy, Addressing Equity and Inclusion, and Fostering Independence in the Spring. Twenty-three (23) mentors attended the Fall workshop, and 12 returned for the Spring workshop. The NRMN evaluation team evaluated the workshops’ effectiveness. We will report the results that overall the peer mentors found the training was a valuable use of their time and that it increased their confidence to be peer mentors for the PREP and IMSD trainees effectively. Additionally, through this process, our four NRMN-trained facilitators gained experience through leading and observation to expand the workshop offerings to other populations and pilot new modules in the next year.

References:

Creating and Implementing a Communication Plan for the NIH/NIGMS/TWDD Research Training Programs at Virginia Commonwealth University (VCU)

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In 2010, the VCU Center on Health Disparities (COHD) initiated 3 NIH/NIGMS/TWDD research training programs, supporting undergraduates, postbaccalaureates, PhD students and postdoctoral fellows. These programs increase the number of scholars from underrepresented groups that enter biomedical and biobehavioral science careers. An improved communication plan was required to reach a growing and complex web of stakeholders, including >40 current trainees, >100 alumni, >75 research mentors, applicants, and VCU leaders. The plan’s purpose is to highlight major trainee and program accomplishments, and the favorable position of the programs for continued success and expansion. The goals include: to facilitate networking of current trainees with alumni and near peers, to recruit candidates, to educate VCU faculty and administrative colleagues about the programs’ value, and to maintain and expand fiscal and other support. Consultation with VCU communication experts allowed design of a plan that emphasizes the strengths and uniqueness of the COHD training programs, and the successes of individual trainees to put a face on the programs. Thus far, a LinkedIn group was created with >80 current and alumni trainee members. In addition, a slide show of trainee photos and successes was prepared and presented at the VCU 50-year anniversary symposium. Seven mentoring groups with trainees at all levels were created. An annual alumni and trainee networking event was instituted and well-attended. A new NCI proposal to expand the number of underrepresented trainees impacted was submitted. Immediate measurable results include the number of meetings of mentoring groups, number of alumni meetings with trainees, number of trainees getting jobs or applying to programs under advice of alumni, number of applicants, and the number of new mentors recruited. Ultimately, the impact of the plan will be measured by renewal of the grants, funding of new proposals, increased participation by faculty mentors, and continued support by VCU administration.
RISE – Poster Board #87

Promoting Team Building, Collaboration and Communication Skills in Graduate Students through Interactive Scientific Retreats

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Graduate students in the biomedical sciences receive intensive training in their scientific area. Tools to help them find balance between work and personal life are still needed to ensure a successful graduate experience. Based on student feedback, we developed an off-site yearly retreat focused on enhancing students’ ‘soft skills’ and professionalism in a less formal atmosphere. **Aim:** To promote team building, improve collaborations and enhance communication skills. **Approach:** Retreat themes of “Who am I?”, “Leadership: A path to independence”, “Assertive Communication: key to success”, “Career Diversity”, “Science and Wellness” and “How to become a Science Ambassador” were addressed through short presentations, case studies, live podcast, webinars, focus groups, role play, and breakout sessions with various team building exercises to practice communication skills, and identify abilities, knowledge, values and behaviors. Prior to the retreat, participants were provided with relevant articles, books and case studies. Team building exercises and interactive activities accompanied the sessions. Guest speakers with expertise in the retreat theme participated in discussion sessions with the students. Evaluations were completed by all trainees. **Outcomes:** Over the past 6 years, a total of 32 trainees, 9 RISE Program faculty and staff, and 15 external speakers from industry, academia, media/journalism, the arts, psychology and holistic medical fields participated. 100% of the participants agreed the experience was productive and beneficial, with a good balance between talks and hands-on activities. Trainees stated that the retreats allowed them to gain a better perspective of their strengths/weaknesses, how they ‘fit’ into the RISE community, and provided them with the motivation and inspiration to reach their scientific and personal goals. **Conclusions:** Off-site interactive science-related retreats are a valuable tool for enhancing soft skills and sense of team identity in a biomedical sciences graduate program, while covering important issues related to pursuing a career in science.

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After-EXITO: Community-Based Participatory Research to Improve Alumni Transition from an Intensive Undergraduate Research Program

Dora M. Raymaker¹, Mirah Scharer¹,², Ashley Widmer², Dhale Larsen Posadas², and Rebecca Miller¹

¹Portland State University, ²BUILD EXITO alumni

Motivation: The BUILD EXITO program is an intensive, NIH-funded undergraduate program to support students from underrepresented backgrounds in pursuing research careers in biomedical, behavioral, clinical, health, and social sciences. After completing the program, Scholars pursue a variety of pathways with respect to education and employment. This project aimed to engage program alumni as co-researchers to qualitatively investigate Scholar needs and preferences for post-program support and make recommendations based on findings.

Approach: We used a community based participatory research approach¹ to form an equitable partnership between Portland State University, a majority of BUILD EXITO alumni, and staff from within the BUILD EXITO community. We collaboratively developed all project materials, interpreted findings, and created recommendations. We recruited current and former EXITO Scholars to participate in qualitative interviews regarding their experience of program transition. We conducted an inductive thematic analysis of data at a semantic level to discover key themes and organized specific recommendations under each theme.

Outcomes: We interviewed a diverse group of 11 alumni representing a variety of post-program pathways (completing undergraduate, graduate school, employment or other goal). Key themes centered around: transition as a “bittersweet” experience; maintaining relationships with research labs; customized enrichment or advising to prepare; staying connected with alumni and current scholars; and one-on-one and ongoing mentorship and advising. Concrete, actionable recommendations were offered around each of these themes both by research participants and by Scholars in our CBPR group.

Lessons learned: Community based participatory research is a feasible approach to engage students equitably as co-researchers in education research. Students have valuable perspectives to contribute not just as data sources but in how education research is conducted, and what questions are being asked. Intensive undergraduate programs may want to more deeply consider the views of alumni around transition and how they can better support students during transition.

NRMN – Poster Board #7

NRMN-Resource Center: A National Resource for Mentorship, Networking and Professional Development

Vishwanatha, J.K., Ahmed, T., Javier, D., Stinson, K. and Short, A.

National Research Mentoring Network-Resource Center, University of North Texas Health Science Center, Fort Worth, Texas.

The rapid growth and accumulation of specialized knowledge in today’s biomedical fields, combined with entrenched and emerging health issues that persist among certain groups within the U.S. population, emphasizes the significant need to diversify the nation’s biomedical science workforce (1-3). The underrepresentation of minorities in science results in inadequate scientific input from divergent social or cultural perspectives and detracts from our nation's ability to resolve health disparities.

The National Research Mentoring Network (NRMN)-Resource Center, a National Institute of Health initiative, will provide resources for students and scientists across all career stages of research in the biomedical, behavioral, clinical, and social sciences with mentorship, networking and professional development opportunities. There are over 13,000 mentors and mentees registered within the NRMN network, representing all 50 states and Puerto Rico, of which 55% are from underrepresented groups in the biomedical sciences. As we transition to NRMN Phase II, the NRMN-Resource Center will be expanding the resources for each career stage to aid the individual in their scholastic and research journey. These resources include:

- An integrated guided virtual mentorship and networking platform for mentors and mentees to network as well as participate in various forms of mentoring such as one-on-one mentoring, near-peer mentoring, group mentoring, peer mentoring
- Customizable guided virtual mentoring sub-communities for individual NIH programs, professional societies, institutions and other programs/organizations to provide catered guided virtual mentorship and networking to their members
- Online feature to create a Curriculum Vitae (with shareable link) and Individual Development Plans
- Mentoring and professional development resources available through NRMNnet.net that are tailored to key career transition stages
- Professional Development Webinars and NRMN podcast
- Social Media Outreach will engage in innovative social strategies to engage incoming and existing members and serve as an additional tool the community of initiatives, resources, and upcoming opportunities.

References:
Building the Postdoc Academy: A Digital Professional Development Program for Postdocs

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1Professional Development and Postdoctoral Affairs, Boston University; 2Searle Center for Advancing Learning and Teaching, Northwestern University; 3Graduate School, Michigan State University; 4Wisconsin Center for Education Research, University of Wisconsin-Madison; 5Delta Program, University of Wisconsin-Madison; 6Feinberg School of Medicine, Northwestern University

Professional development is critical for postdocs to develop skills beyond the technical focus of their research. Participation in professional development programming can be difficult for postdocs due to the expectations of their research group and personal commitments (McDowell et al., 2015). To address this gap, the Postdoc Academy is creating a flexible professional development program. Postdocs nationwide can participate entirely online or join a blended (online with in-person meetings) community. Our program will utilize active-learning techniques and support postdocs from orientation to their next career step.

The Postdoc Academy will officially launch in January with the release of a MOOC (Massive Open Online Course) on Postdoc Orientation, covering foundational skills and career planning. To ensure the content we provide is relevant, approachable, and inclusive for postdocs of all stages and disciplines, our team has conducted multiple feedback sessions with small groups of postdocs. These focus groups have provided data which helped shape the final content for the Postdoc Academy. In addition to listening to and incorporating the feedback of postdocs, we have also weaved their stories throughout our content. The goal of the Postdoc Academy is to build a supportive, inclusive community for postdocs on their journey to success.

We welcome your engagement by providing feedback on our content, joining our community, or adapting and using our open educational resources.

References:
Abstract: Background: Current research training involves graduate students and post-docs joining a lab and being mentored by the principal investigator and the more senior trainees in the group. This system builds deep domain knowledge with focus on the scientific details. The purpose of the IMPACT program is to develop and demonstrate education methodology to train graduate students and post-doctoral associates to rigorously conceptualize the potential impact of a research project throughout the research course. Methods: IMPACT is a supplemental voluntary training program for trainees in the greater Boston area. The IMPACT Fellows and program faculty were drawn from a range of research areas and sectors, with no attempt to match the deep expertise of faculty with the project areas of the Fellows. A series of ten 3-hour sessions were held over a semester, during which the Fellows were challenged to articulate their research and its potential impact. We also required that the Fellows gather evidence from experts and stakeholders about assumptions and ideas related to the potential value (impact) of their work. Independent program assessment has been conducted by the Teaching and Learning Lab at MIT. Outcome: 96% of Fellows found the IMPACT program to be a powerful learning experience. >75% reported they were more able to identify gaps in their research, and the steps needed to drive their work towards impact. >90% stated they were more effectively able to discuss their work with diverse audiences. >80% reported that stakeholders led them to rethink the long-term direction of their research. Trainees reported that this program positively impacted their education in enabling better planning of, and ability to communicate, their research, and in particular to consider the long-term implications of their research during its execution. This type of programming is compatible with standard training programs.
Breaking the Bias Cycle for Future Scientists: A Workshop to Learn, Experience, and Change

Christine Pribbenow, Kate McCleary, Donald Dantzler, Jahmese Fort, Percy Brown Jr., and Molly Carnes

University of Wisconsin-Madison

Do You Play Fair? A Workshop to Address Bias in Academia is a 3-hour workshop that integrates Fair Play with the bias habit-reducing strategies from Carnes’ previous work to address race-based bias against Black/African Americans in STEMM (2015). Fair Play is an avatar-based video game where players take on the role of Jamal Davis, a Black graduate student at a large research university who must navigate increasingly difficult explicit and subtle forms of racial bias in order to earn a PhD and become a professor. Research about Fair Play indicates that the game is an accurate portrayal of experiences of Black students in postsecondary education and that it is an effective way to teach university faculty about implicit bias (Kaatz et al., 2017). Since 2015, the workshop has been presented to over 900 participants, including faculty, postdoctoral scientists, and graduate students at eleven conferences and fifteen postsecondary institutions. Evaluation results indicate that 100% of the participants agreed the workshop is an effective way to teach people about bias (69% “agreed” and 31% “strongly agreed”); 100% responded affirmatively that the workshop increased their understanding of bias and its impact (77% “agreed” and 23% “strongly agreed”). Approximately three-quarters (67%-75%) reported being “very motivated” or “motivated” to identify bias in their environment, such as asking questions to better understand an individual’s experience rather than assuming it is similar to their own, seeking out opportunities to interact with individuals who are different than themselves, and addressing bias at their institutions. A research study is currently being conducted to identify how the workshop participants applied their learning to address bias within themselves as well as at their institutions, after one to three years post-participation.

References:


The growth of biomedical entrepreneurship within academia is being driven by the motivation of biomedical scientists to convey their innovative medically-related ideas or discoveries to patients. However, the number of scientists interested in entrepreneurship or appropriately skilled to advance their ideas into successful business ventures is small, in part due to lack of training. This is particularly true in the Institutional Development Award program (IDeA)-defined states because of the limited accessibility to entrepreneurship training opportunities. The overall goal of this project is to develop a training program that promotes entrepreneurship in biomedical research and facilitates the transition of innovative ideas and discoveries from bench to bedside and into the marketplace.
Motivation: Toxicology is an uncommon career choice for students enrolled at US colleges and universities due to lack of exposure of undergraduates, especially underrepresented students, to the toxicology field. This limits the depth and breadth of the pool of undergraduates applying to graduate programs in toxicology because this career path may not be clearly recognized. The Toxicology Mentoring and Skills Development Training Program (ToxMSDT) is a one-year, holistic training program, which serves as a pipeline for early recruitment of underrepresented students in STEM into the toxicology profession and related areas. It is a collaboration between Iowa State University, Tuskegee University, and The Ohio State University.

Approach: The ToxMSDT program provides underrepresented undergraduate students early exposure to research experiences and to the fundamentals of toxicology through 1) Paired student mentee-mentor teams participating and networking in 4 professional meetings/conferences; 2) Responsible conduct of research training; 3) Online learning modules accessible 24/7; and 4) Externship experiences at mentor work facilities. Participants receive certificates of completion.

Outcome: 21/30 (70%) of ToxMSDT graduates are still enrolled as undergraduates and have engaged in further undergraduate research activities such as USDA forest service, MARC U*STAR fellowship program, SURE Tox, and Ecotoxicity research programs; 5/21 (23.8%) applied or are in the process of applying to graduate programs and medical schools; 7/9 (77.8%) of our mentees from both cohorts, who have graduated from college, have enrolled in Ph.D. programs (Toxicology, Molecular and Systems Pharmacology, Biochemistry, Chemistry), or Dental and Pharmacy schools.

Lessons: ToxMSDT has exposed underrepresented undergraduate mentees to the diverse toxicology field and built fruitful relationships with role model mentors who have a passion to diversify the toxicology workforce. The full impact of the program will take time to be realized, as the majority of the mentees are still enrolled in colleges, but early results are encouraging.

References:
7. Online learning modules accessible 24/7 and to the general public as a web resource http://www.toxmsdt.com
Increasing Graduate Program Diversity and Enhancing the Student Experience

Kristin Cooper and Anjon Audhya

1Molecular and Cellular Pharmacology Graduate Training Program, University of Wisconsin-Madison

The Molecular and Cellular Pharmacology Program is one of the basic science programs at the University of Wisconsin School of Medicine and Public Health (SMPH). In recent years, the University as a whole and the SMPH have increased their commitment to create a diverse, inclusive, and excellent learning and work environment for all students, faculty, staff, alumni, and others who partner with the university. One of our primary goals as a program is to create a learning environment in which students feel connected, supported, and able to accomplish their career aspirations. Diversity among students can help to enrich the student educational experience. To accomplish this goal, we have worked to increase the diversity of our student population, create avenues for students to get to know one another better, and connect with students to find out their individual needs and aspirations so we can best serve their needs.
The Program in Enhanced Research Training at OHSU

Cheryl L. Maslen

1Director, Program in Enhanced Research Training, Oregon Health & Science University

The OHSU Program in Enhanced Research Training (PERT) is a T32-supported predoctoral fellowship program that is designed to provide ancillary research training skills that are not part of the standard graduate program curriculum. This includes development of soft skills such as scientific communication, how to optimize interactions with mentors and dissertation advisory committee members, how to write a successful fellowship application, networking, team building, and other career development skills. There is also a Peer-to-Peer Mentoring program embedded in PERT where former PERT students serve as peer mentors to the current PERT cohort. Our motivation for this program is to discover and fill in educational gaps in areas that are not traditionally taught in graduate programs, yet enhance the abilities of trainees to succeed in research. PERT is an evolving program that learns from graduate trainees and makes annual curriculum adjustments based on trainee feedback. This approach ensures that we are meeting the training needs of our students by gathering information throughout the course of their graduate education and applying it in the form of courses, workshops and other educational activities that address unmet training needs. This is done through a survey of PERT students at the end of their training year, and through feedback forums with all graduate students including former PERT students and those who were not selected for the PERT program but have participated in some of the PERT activities over the years. New curriculum content is developed for newly identified areas of need. Outcomes are measured by tracking tangible successes of our trainees in terms of publications, fellowships obtained, honors and awards. Additional long-term outcomes will be assessed as the program matures. This will include evaluation of time-to-degree completion and indices of an upward trajectory in career development post-graduation.
Laboratory Modules to Enhance Biotechnology and Chemistry Biology Interface Training Programs

Eric Strieter, Jeanne Hardy, Shelly Peyton, and Lynmarie Thompson

The UMass Biotechnology Training Program (BTP) and Chemistry Biology Interface (CBI) program have joined forces to develop a set of Laboratory Modules to enhance training and research for our students. This effort builds on the 10+ years of experience of BTP faculty teaching Laboratory Modules (see https://btp.umass.edu/events/btp-lab-modules/) and takes advantage of recent campus investments in new core facilities. Laboratory Modules aim to provide technical and theoretical training on very specialized research techniques, particularly techniques that are of great use to individual research projects, but are outside the expertise of the home research lab of a trainee. Such skills and cross training in cutting-edge techniques, coupled with deep training in one discipline, are under high demand for industrial positions in pharma and biotech. UMass is uniquely positioned to expand the offerings of Laboratory Modules and provide this type of relevant laboratory-based training to our graduate students. The university has recently made significant investment in 26 new state-of-the-art core facilities as part of the Institute for Applied Life Sciences, which was recently established with a $95M grant from the Massachusetts Life Science Center and investment of over $45M by the UMass campus. We have developed eight new Laboratory Modules that provide training in these core facilities and serve both CBI and BTP trainees. Modules are developed and co-taught by CBI or BTP faculty in partnership with the core facility director. Each module: (1) begins with key elements of experimental design for that method, (2) includes theoretical underpinnings of the method with examples of the importance of understanding these to obtain sound results (discourage the use of instruments like a “black box”), and (3) culminates with statistical analysis of the resulting data, again incorporating examples of how shortcuts lead to erroneous conclusions. Including this practical training in best practices for rigor and reproducibility as a theme throughout all modules will lead to a lasting change in each student’s thinking that will extend into other areas of their research. Thus, the new modules enhance training with exposure to specific techniques as well as reinforcement of broadly applicable research skills.
Rigor and Transparency in Graduate Education: Collaboration with the Center for Open Science

Gordon W. Laurie1-4 and Karen Hirschi1,4

Departments of Cell Biology1, Ophthalmology2 and Biomedical Engineering3, Biotechnology Training Program4, University of Virginia

Rigor requires robust and unbiased experimental design, methodology, analysis, interpretation, and reporting. Reproducibility demands that methodology, data, and analysis are transparent so other scientists can verify published findings, conduct alternative analyses, or replicate the results by collecting new data. In April 2015, the BTP initiated a collaboration with the 'Center for Open Science' (COS). COS' thesis is that research efficiency, integrity and reproducibility must be cultivated by openness and transparency. Towards transparency, COS established the free and cloud-interactive 'Open Science Framework' - essentially a resource-rich electronic notebook - for open experimental design and management of data. We feel that all graduate students, particularly our T32 students and mentors, should become disciples of transparency in science, and accordingly in February 2016 COS' Tim Errington and Courtney Soderberg were recruited (and Tim continues yearly) to teach in the BTP core course 'Essentials of Translational Science'. By structuring experimental design and data organization in a preregistered controlled or open sharing manner, the Open Science Framework (http://osf.io/) helps implement rigor and reproducibility into the research workflow. We just became aware of COS' one day hands-on Open Science Framework workshop offering that we will now provide yearly in late August or September for all entering and current trainees. The timing is perfect with trainees just entering into research after having completed their heaviest course work year. New BTP trainee funding will be contingent on satisfactory completion of the workshop by collaborating mentor-mentee pairs. Also, trainees will share Open Science Framework projects with Major and Minor mentors and with their thesis committee. This provides structure to the responsible conduct of research in a manner that should lead to more enlightened guidance. As further reinforcement, COS will continue to help teach our core course in the Spring.

References:

https://cos.io
https://cos.io/our-products/osf/
A Wellness Initiative to Improve Mental Health and Well-being Among Graduate Students

Matthew Welch¹, Iswar Hariharan¹, David Bilder¹ and Wendy Ingram²

¹Department of Molecular and Cell Biology, University of California, Berkeley; ²Bloomberg School of Public Health, Johns Hopkins University

Mental health issues are a growing concern in graduate education [1]. A report by the University of California, Berkeley Graduate Assembly, published in 2014, revealed that 43-47% of graduate students in the biological sciences showed signs of depression [2]. Our own anecdotal experiences in the Department of Molecular and Cell Biology (MCB) at UC Berkeley also suggest that many students experience mental health issues during their graduate careers. Our community was also impacted by two suicides of former graduate students, which underscored the need for urgent action. In response, graduate students in the MCB graduate program first established the MCB Graduate Network, a student group focused on peer-peer counseling and wellness initiatives. Faculty in the MCB Department subsequently established a Wellness Committee consisting of students (undergraduate and graduate), postdocs, staff, and faculty. The stated goals of this committee are to raise awareness and de-stigmatize discussion of mental health issues, inform departmental policy, make mental health resource information easily accessible, and facilitate rapid response to mental health crises. Initial committee efforts included arranging for presentations on mental health awareness at departmental retreats. These talks improved mental health knowledge, decreased stigma, and improved attitudes towards seeking mental health care among attendees. Subsequent efforts included holding a “Wellness Day” featuring outside speakers, group exercises, and wellness practices. A voluntary faculty training on recognizing and responding to mental health issues was also held. Surveys pre- and post-training reported an increase in faculty preparedness to identify and respond to student mental health concerns. By continuing to foster awareness and encourage open discussion of mental health, we hope to create a more satisfying and productive educational and work environment.

References:
Gamification Improves Retention of Medical Knowledge for MD-PhD Students during Their PhD Research Years

Randy L. Seay, MA, MPA, MPH; William Webb, PhD; Mark Pepin, PhD; James H. Willig, MD, MSPH; William M. Geisler, MD, MPH; Robin G. Lorenz, MD, PhD

University of Alabama School of Medicine, University of Alabama at Birmingham, Birmingham, Alabama

**Purpose:** To determine whether a spaced-repetition, online learning platform could be used to promote clinical knowledge retention with MD-PhD students during their PhD research years.

**Method:** 63 MD-PhD students were invited to participate in the Kaizen-MSTP online game platform across two preliminary (troubleshooting) rounds and four competition rounds. Incentives were used to encourage participation, and we evaluated whether increased participation was associated with increased retention of clinical facts in a game. Qualitative feedback was also collected to determine whether players in their PhD research years found participation useful as a study aid prior to their return to clinical clerkships.

**Results:** With an average of 23 active participants in each competition round, analysis of variance revealed significant differences in average scores depending on how many times a question was repeated, ($F_{4, 19.47} < 0.0001$), with post-hoc analysis revealing significant improvement between multiple individual rounds. Increased participation and progress through the research phase of the MD-PhD program both exhibited trends toward improved performance.

**Conclusions:** Coupled with encouraging feedback from participants, our findings suggest that gamification and spaced-repetition may be a useful ways to encourage clinical study and promote retention of medical knowledge during the PhD research years of students in MD-PhD programs.

**References:**

T32 Predoctoral – Poster Board #30

NIGMS Training Program in Biomolecular Science and Engineering at Rensselaer Polytechnic Institute (RPI) in Collaboration with the University at Albany

Deepak Vashishth Ph.D.¹

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Fully exploring linkages between biology and engineering and identifying new opportunities requires the bridging of disciplines that are central to biotechnology. One such area is biomolecular science and engineering, where engineering principles are used to understand, design, manipulate, and apply biological macromolecules in a range of contexts. Biomolecular science and engineering accommodate the increased interactions of engineers and life scientists to spur growth in areas such as synthetic biology, stem cell biotechnology and therapeutics discovery.

The NIGMS Training Program in Biomolecular Science and Engineering at RPI (Prof. Deepak Vashishth, Director), in collaboration with University at Albany (Prof. Marlene Belfort, Associate Director), is dedicated to the education of a broad cadre of predoctoral students spanning both life sciences and engineering. The program provides an integrated and multidisciplinary platform to broadly train predoctoral students at the interface of biology and engineering, focusing on the quantitative linkages that define this interface and preparing Trainees for careers in biotechnology.

Key outcomes of the program include a well-balanced interdisciplinary predoctoral training program in biotechnology with coursework and training in data science/analytics, professional development, entrepreneurship and commercial translation and a strong public-private partnership with industry and healthcare providers. Eight new Modular and Project-based unITs (MAP-IT) have been added to enhance rigor and reproducibility for graduates of our program. Graduates of the program have gone on to success in both academic (31%) and non-academic (69%) careers in broad areas within biomolecular science and engineering including environment and public policy, government, pharmaceutical industry and/or created new companies (https://biotech.rpi.edu/students/nigms-bse). Recent efforts focused on recruiting students with disabilities/disadvantaged backgrounds and/or students from URM populations. Since 2015, ~30% of NIGMS-supported Trainees have been from URM populations and 9% have been Trainees with disabilities/disadvantaged backgrounds.

References: None

Acknowledgements: NIGMS (T32GM067545 – Vashishth, Deepak PI)
A Novel Clinical Skills Program for MD/PhD Candidates

Samuel Oliver, MD¹; Amanda Ward²; Richard Bayliss, PhD²; Brian Uthlaut, MD¹; Dean Kedes, MD, PhD³.

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³ Department of Internal Medicine, Division of Infectious Diseases and International Health, University of Virginia, Charlottesville, Virginia

Students in the Medical Scientist Training Program (MSTP) at the University of Virginia (UVA) pursue both MD and PhD degrees during their education; pre-clerkship curriculum the first two years and then on average five years of research. After completing their PhD, MSTP students return to clerkship rotations. The transition back to medical training is typically stressful due to the prolonged separation from clinical education. We initiated a pilot study surveying UVA MSTP students on their perception of retention of clinical knowledge through the graduate/research training period. Greater than 70% of MSTP students responded that they would benefit from more integration of clinical and graduate education. In the same survey, 95% of respondents said they would be interested in attending clinical skills retention sessions during their graduate training. To address these concerns we created a novel clinical skills review curriculum for MSTP students during their graduate training. The course consists of five clinical skills sessions and an Observed and Structured Clinical Exam (OSCE). Each skills session consists of a didactic session focused on history and physical exam followed by simulated cases with Standardized Patients (SPs) and a clinical skills workshop. These sessions are organized by organ system with workshops addressing skills of clinical reasoning, note writing, and empathic interviewing. All clinical encounters are supervised by residents or faculty from the UVA Department of Medicine. The observer provides immediate feedback and teaching on history-taking, physical exam, and presentation skills. Surveys were administered to MSTP students to assess their comfort with clinical skills. A longitudinal hospitalist shadowing experience will begin summer of 2019 with a repeat OSCE at the end of 2019. We are examining incorporating the program into the existing preclinical skills curriculum for continued longitudinal development.
Transdisciplinary Predoctoral Training at the Interface of Chemistry and Biology

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The complex problems encountered across length and time scales in treating disease require a broad repertoire of skills along with the capacity to harness teams possessing a range of diverse expertise to advance the discovery of new therapeutics and diagnostics (1). In order to address the pressing public health needs of the 21st century, the next generation of researchers must be able to think and communicate in a common language that spans chemistry and biology. The Chemistry of Life Processes (CLP) Predoctoral Training Program is addressing this need by providing Northwestern University graduate students with the opportunity to integrate graduate studies in chemistry and the life sciences through coursework requirements, a novel immersive cross-disciplinary lab experience, and unique mentoring structure. The program is built upon the highly collaborative, transdisciplinary biomedical research programs of 48 mentors with extensive expertise in the areas of drug development, molecular modeling, and identification of potential targets for therapeutic intervention. The CLP Training Program has created a multi-dimensional platform for interdisciplinary training and education that incorporates didactic, experiential and communal training experiences to provide our students with the diverse skill sets and broad thinking needed to address the big questions of 21st century biomedical research. Over the past six years, the CLP Training Program has developed a cadre of 33 students, drawn from five graduate programs, who share the language, methodological approaches, and perspectives of both chemistry and biology. Current and former trainees have strikingly attested, in externally moderated focus groups and online surveys, to their perception that this program has set them apart from their peers in terms of laboratory skills, breadth of knowledge, collaboration and team building skills, and use of multi-disciplinary approaches to problem solving.

References:

Introducing Early-Stage Trainees to Collaborative and International Science

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Motivation: First-year graduate students have little experience in self-directed scientific research, and they seldom have interacted professionally with scientists from outside the US. Approach: The Boston University Program in Bioinformatics introduced two novel components to the training of early-stage graduate students: (1) the Challenge Project; (2) the International Workshop in Bioinformatics and Systems Biology (IBSB). Outcomes: The Challenge Project has been in place for 11 years. It has been effective in introducing first-year graduate students to team science, and in showing them how to effectively collaborate on a project that they direct themselves. Challenge Project teams frequently present the results of their projects at the IBSB and at international scientific conferences (ISMB). Trainees have published papers on their projects, been chosen for oral presentations at ISMB, and received Best Poster awards. The IBSB has run continuously since 2001. We alternate venues each year with our international partners in Berlin and in Kyoto. Most talks are given by trainees from the three graduate programs. A key outcome is the opportunity for the graduate students to meet peer trainees and senior scientists from other countries in a relaxed but scientifically focused workshop. Lessons learned: For the Challenge Project, we have found that it is crucial to provide instruction in how to effectively collaborate with team members having diverse backgrounds. For the IBSB, we had initially expected that the annual workshops would lead to trainee interest in extended visits to labs in other countries to learn techniques and collaborate. We provide funding for these visits. We found, though, that few trainees showed interest, probably because extended visits were perceived by them and by their mentors to interrupt their ongoing research.
A Continuing Clinical Education Course to Maintain Clinical Competencies and Foster New Clinical Knowledge During the Graduate School Years of MD/PhD Training

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Most students in combined MD/PhD programs take a leave of absence during medical school training to complete their PhD degree. This extended period away from clinical activity can be detrimental to both clinical skills and clinical knowledge, placing dual degree students at a disadvantage when they return to medical school clerkships. In addition, MD/PhD students often have fewer elective rotations during their third and fourth years of medical school, limiting opportunities to explore the different medical specialties available for residency or fellowship training. Finally, many students experience significant anxiety about their preparedness for clerkships.

We developed a Continuing Clinical Education Course for MD/PhD students in their graduate school years to maintain and build on clinical skills and knowledge acquired during the first two years of medical school and to increase exposure to different medical specialties. This required course features a three-pronged curriculum: 1) clinical encounters (H&Ps with residents or volunteering at a student run free clinic), 2) shadowing experiences with clinical faculty, and 3) clinical knowledge sessions (simulation labs, New England Journal of Medicine case conferences, and resident morning reports). Each student spends about 12-15 hours per semester completing course activities and a course evaluation and receives a letter grade based on the number of activities completed. Students in their final graduate school year may also voluntarily attend clinical workshops (e.g., reading EKGs) and shadow an internal medicine inpatient service team to gain further clinical knowledge and skills. We expect this course to better prepare our students for returning to clerkships and for being competitive when applying to residency.

Our outcomes are currently being assessed through student survey results. Lessons learned include changes in the types of activities offered and grading scheme since the course was initiated. Outcomes and lessons will be presented in our poster.
Hypothesis, Design and Biostatistics

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Using NIGMS T32 supplement funds, we developed a new curriculum for pre-doctoral trainees with the title ‘Hypothesis, Design and Biostatistics’ (GPLS630). The goal of this course was to train students in principles of rigor and reproducibility, ethics, and decision-making in science, merging elements from a previous course and proseminar covering hypothesis testing, experimental design, and biostatics in the Graduate Program in Life Sciences (GPiLS). The course is best described as a hybrid curriculum with a modular structure. It features recorded videos, online problem sets, and quizzes for the students to complete prior to class. In-class time is spent in instructor-guided small groups reviewing problem sets and discussions. Each module is self-contained and features a similar format, so students gain familiarity with the teaching style and course expectations. The goal is to inform the trainees’ laboratory research and enhance rigor and reproducibility via integration of the course principles. Due to the success of this course, the umbrella GPiLS program at UMB has put additional support/resources into the course to expand it even further and make it available to all life sciences students. To develop the course, T32-affiliated faculty members worked with the new Academic Innovation and Distance Education (AIDE) Center at UMB to design and develop student-centered, engaging, learning experiences. Teaching materials are now recorded and on-line the course is sustainable and agile. The modular nature of the course means that new topics can be easily integrated as the need arises. The course can be scaled to meet the needs of all NIGMS T32 students within GPiLS (including the MSTP). The course can be extended to other T32 programs at UMB, UM system campuses, and NIGMS programs at other sites. We have now trained 100 students in this course, and it is now very popular and in high demand.
Biomedical Career Development Forum for Pre-doctoral Students at Northwestern University

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Motivation: Career development events at Northwestern for life science pre-doctoral students are conducted as one-off workshops or networking events focused on a specific theme or topic. The disadvantages of this approach are: 1) students/postdocs must find time to attend multiple events, 2) there is no continuity between events, and 3) there is limited in-person networking opportunities during short events.

Approach: NIGMS-supported training programs at Northwestern organized an intensive two-day event focused on panel discussions and talks exploring a variety of career options, practical sessions led by career professionals on how to land a job and prosper in those careers, and ample networking opportunities over mixers and meals. We organized pre-event workshops to ensure attendees had up-to-date résumés, reinforced networking strategies, and discussed approaches to presenting research to professionals outside academia. A committee of trainees selected career themes, identified and invited speakers, and moderated the sessions.

Outcomes: The response from both attendees and panelists was overwhelmingly positive and attendance vastly exceeded initial estimates, indicating pent-up demand for this type of an intensive event. An unexpected benefit to the panelists was it afforded them opportunities to network with other professionals. Students particularly appreciated the insights of insiders spanning a broad range of careers and made new professional connections.

Lessons Learned: 1) Students seek exposure to a wide variety of careers. 2) Introducing students to professionals on campus, especially alumni, facilitates networking. 3) Panelists benefitted from connecting with emerging talent and ongoing research in academia. 4) Pre-workshops organized as one-off events were not as well-attended. 5) Students connected with specific panelists via LinkedIn based on the interactions at the event instead of connecting indiscriminately with all panelists.

Sustainability: We anticipate organizing this event every 2 years, ensuring every pre-doctoral trainee would benefit from this opportunity at least twice during their PhD career.
Biomedical researchers make incredible breakthroughs every day, but policy-makers and the public rarely have knowledge of their work. Although PhD programs train students to communicate with other scientists within their disciplines, few PhD programs train students to communicate with the public, despite the clear need for this type of training1,2,3. To fill this gap, the Division of Biology and Biomedical Sciences (DBBS) at Washington University in St. Louis developed a project-based Science Communication Credential (SCC) program that integrates into existing PhD training. This curricular innovation creates a pathway for PhD students to enhance their scientific communication skills and to provide outreach to the general public, which are important professional skills for all biomedical scientists4. To earn the credential, students develop a portfolio of publications (articles, blog posts, podcasts, and live talks) that demonstrate their communication skills and receive a digital badge of accomplishment that integrates with their online LinkedIn profile. The SCC program launched in January, 2019 with 17 PhD students enrolling. All enrolled students have completed at least one training requirement toward this self-paced credential. We created a website5, developed on- and off-campus publishing opportunities for students, and held focus groups with 60 students to assess science communication training needs. This research led us to host a storytelling workshop with trainers from StoryCollider and a local public radio station. No students have yet completed the credential program, but 2 are close to completion. Assessment of the pilot program is ongoing and measured in two ways: a self-report survey of student confidence levels in communication skills and rates of publishing productivity for SCC students. Pre-surveys have been distributed with post-surveys planned for fall 2019. Future plans include opportunities for SCC students to meet as a cohort to facilitate peer mentoring and support timely completion of the credential.

References:


5. Science Communication Credential https://sites.wustl.edu/scicomm/
The overarching goal of the Pharmacological Sciences Training Program at the University of Michigan is to prepare graduates to excel as leaders in the field of experimental therapeutics. The motivation for the development of a new course was the recognition that strong competencies in experimental design, data management, rigorous data analysis as well as data presentation and visualization are key to achieve such goals and that existing ad-hoc approaches were not effective, especially given the diverse educational backgrounds of trainees. Our approach is based on a combination of strategies including 1) didactic presentation of concepts in the context of day-to-day laboratory experiences, 2) flipped classroom approaches to provide foundational material, 3) multiple simulation tools to illustrate concepts dynamically, 4) experiential hands-on computer laboratory sessions for skill building with analysis software tools, and 5) opportunities for team learning through discussion and problem-solving sessions. Analysis of outcomes revealed that the course has a measurable impact in acquisition of skills and confidence in their implementation. This has led to the adoption of the course as an integral part of the curriculum for both Ph.D. and master’s students. Based on student and formal evaluation feedback, the scope of the course has expanded to offer increased hands-on experience and a broader coverage of topics. Lessons learned from our experience are that there is a significant need for this type of instruction and that the use of practical concrete examples relevant to pharmacological sciences is most impactful. The use of direct analysis and critique of examples from the primary literature in a discussion setting provides an effective mechanism for gaining competencies. We further envision this course as a means for the trainees to develop critical thinking and data interpretation skills that can positively impact their readiness for candidacy examinations and successful development as scientists.
To advance interdisciplinary biomedical research, teams of scientists with differing perspectives and backgrounds need to work together efficiently and effectively in the pursuit of research aims. Despite the importance of managerial and leadership skills to scientific achievement, we have found in trainee surveys that PhD students typically feel underprepared to deal effectively with the human dynamics of the workplace, even by the time they graduate. This lack of managerial preparedness is echoed in our discussions with industry professionals, who would like their PhD level employees to be more managerially savvy.

To address this skills gap, Dr. James Patton, PI of the Cellular, Biochemical, and Molecular Sciences Training Program (CBMS), collaborated with the Biomedical Research Education and Training Office of Career Development to develop a pilot program, Leading and Managing People and Projects. CBMS seeks to train students to bridge disciplines spanning cellular, biochemical, and molecular sciences. It serves a unique niche at VU as the only training program that is not discipline or disease-specific. The 22 current trainees (18% URMs) and 73 faculty preceptors come from 11 different departments and programs, with CBMS serving as the unifying entity that brings these participants together to spur interdisciplinary thinking and training.

The semester-long program combined didactic exposure to leadership and management principles with case-based projects and a one-day workshop on Difficult Conversations in the Workplace. The goal of the program was to equip trainees with enhanced “people skills” that will help them throughout their training and into their next career step, and to familiarize trainees with established strategies for motivating and leading others to be productive and successful.
Career Exploration and Skills Development

Monn Myat, Alyson Kass-Eisler, Jaclyn Jansen and Alexander Gann

Cold Spring Harbor Laboratory

The graduate school at Cold Spring Harbor Laboratory (CSHL) provides broad biomedical education and training in molecular biology and biochemistry, cancer biology, genomics, systems neuroscience, and quantitative biology. While our graduates benefit from a rich scientific curriculum, a recent survey of our current and former students suggests that they value increased career development programming. In contrast to the fertile research training environment at CSHL, we lack the diverse infrastructure that often exists at large universities, where specialized departments can supplement traditional biomedical education with training in transferrable skills like writing and public speaking. As our alumni enter an increasingly wide array of career paths, we have devised a career development program to meet their needs. It is both structured and customizable to allow students to explore career options while enhancing their transferrable skills, in line with recent evidence that graduate training programs allow students to develop skills that are transferrable across various careers (Sinche et al., 2017).

With an emphasis on experiential learning whenever possible, we have developed a comprehensive curriculum aimed at increasing the students’ awareness and readiness for the diverse array of careers now available in the biomedical workforce. Part I of the program will provide students with an overview of different career paths, instruction on conducting informational interviews, and development of transferrable skills, such as communication, negotiation and mentoring. Part II of the program will allow students to explore specific careers in more detail with opportunities for internships, which have been shown to improve confidence without detracting from time to degrees (Schnoes et al., 2018). Effectiveness of the curriculum will be assessed through multiple online surveys. Curriculum syllabus and resources will be made available online. We anticipate that this program will improve student satisfaction and outcomes in career-oriented graduate training.

References:


Enhanced Career Planning in Molecular, Cell and Development Biology

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Keywords: Careers, IDPs, Skills, Interests, Databases

The T32 Training Grant in MCD Biology at UC Santa Cruz received an administrative supplement in 2016 to better prepare students in our Molecular, Cell and Developmental (MCD) Biology PhD program for diverse career paths.

Motivation: The career outcomes of our trainees resemble national trends: 52% in biotechnology, 17% in staff research positions at universities, 12% in academic tenure-track positions, and 19% in other positions. A responsibility of graduate programs is to inform students about the diversity of careers that PhDs can pursue and to provide training in the skills needed for those careers.

Approach: We developed a Career Planning course for 3rd-year graduate students, first offered in Winter 2017. This course includes two panel discussions, one on academic careers and one on nonacademic careers; guidance from experts in diverse careers on typical paths to those careers and developing the appropriate skill sets; a visit to a start-up company; training students to give effective short "elevator" talks; and working on Individual Development Plans (IDPs) to target each student’s training to her/his selected career goal(s). To facilitate students learning about different job options, arranging informational interviews, networking with employees, and considering internship opportunities, we developed a database of contacts and information about Bay Area biotechnology companies and a database of UC Santa Cruz PhD alumni who have pursued different careers.

Outcomes: We used an anonymous survey tool to assess how helpful our 10 Career Planning sessions were for students and to seek their recommendations for improvements in future years.

Lessons: The students were very enthusiastic about having a Career Planning course available to them and about the sessions we designed. The most appreciated sessions were the panel discussions, visiting a start-up company, and learning how to give short "elevator" talks. The least appreciated sessions were 2 invited guests discussing transitioning to industry and careers in public policy.
A Laboratory Course in Biophysical Analyses of Protein Therapeutics

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A course was created to train students in key analytical methods used in the biopharmaceutics industry. The course focused on fundamental biophysical approaches used in the characterization and quantitation of protein therapeutics. This was accomplished by designing a series of three experiments to: (1) monitor the kinetics of binding between the neonatal Fc receptor (FcRn) and an isotype control monoclonal antibody cIgG-1; (2) determine the energetics of binding between Protein-A and cIgG-1; (3) monitor the enthalpy of unfolding to evaluate the relative stability of the glycosylated antibody relative to the deglycosylated molecule; and (4) determine the glycosylation sites of cIgG-1. The methods used were surface plasmon resonance as applied in the Biacore T200 instrument, differential scanning calorimetry using a Microcal capillary-DSC instrument, isothermal titration calorimetry using a Microcal Auto-ITC 200 instrument, and an Agilent LC-MS.

The range of biophysical methods and the selected instrumentation suite was determined through discussions with the Corporate Advisory Board of the School of Pharmacy regarding their perceived needs as leaders of industrial science as well as feedback from both current students and alumni about their experience as career scientific professionals. Through a collaboration with both in the School of Pharmacy (SOP) and the Molecular Analysis Facility at the University of Washington, (MAF), the experiments were performed using the Analytical Biopharmaceutics Core in the MAF and the Mass Spectrometry Center in SOP. Thirteen students from four graduate programs attended the course, which comprised of a series of in-lab lectures combined with hands on instrumental analysis. Based on the uniformly positive evaluations, the students would appear to have found their experience valuable and would recommend this course to their peers.
Motivation. Modern research in biomedical sciences requires considerable expertise in computational, quantitative, statistical, and experimental analysis. For many years, the graduate Program in Molecular Biophysics (PMB) offered a lecture-based course in biophysical methods to its first year graduate students. Second year graduate board oral (GBO) examinations, however, have revealed that important concepts need to be better assimilated and retained.

Approach. To train students effectively in both “hard” skills (i.e., methods and technology) and “operational” skills (i.e., experimental design and data interpretation), PMB has organized modules that provide direct, hands-on immersion experiences with computation (Unix, Python, Mathematica, MatLab, molecular dynamic simulations), statistical analysis coupled with rigor and reproducibility, and key techniques (optical spectroscopies, X-ray diffraction method, single-molecule measurements, NMR spectroscopy). The enhanced active learning approach concentrates module instruction in a one- or two-week period during which students progress from concepts and theory to experimental design to measurement to analysis, as appropriate.

Outcomes. PMB began to deliver computational modules in September 2016. Experimental modules were initiated in January 2017. All modules are now in place and are required components of the first year of training. The acquired skills have been immediately useful in coursework, laboratory rotations, and understanding of seminar material.

Lessons learned. Students appear engaged. The new mode of instruction, closely monitored by PMB faculty instructors, exposes misconceptions and insufficiencies in background that can be corrected during the modules or guide individual curricular choices. Intellectual independence and knowledge retention are assessed with performance during the GBO, which takes place at the end of the second year in training. Anecdotal evaluation shows that the modules are more effective than the standard lecture format.

Sustainability and Dissemination. The support of the supplement was essential for establishing course material and purchasing necessary supplies and equipment. The reach of the modules is being extended to other NIH-supported training programs.
Computational and Professional Skills for Biomedical Trainees in Therapeutic Sciences

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Keywords: Pharmacology; Career Skills; Computational Skills; Reproducibility

The Harvard Therapeutics Graduate Program, which is supported by a Pharmacological Sciences training grant, offers training in the sciences relevant to discovering and developing novel therapeutics, including the study of drugs in preclinical and clinical settings to improve disease treatment. A major aim is to link training to real-world industrial, clinical, and regulatory activities by requiring students to participate in hands-on internships in non-academic settings. A second major aim is to provide students with the scientific toolkit and skills necessary for therapeutic discovery and development. We were awarded supplements to create curriculum to (1) address rigor and reproducibility through quantitative and computational skills and (2) develop professional skills to foster success in diverse career paths. (1) The Statistical Modeling using MATLAB course was motivated by our students’ need for a strong foundation in computation and statistical analysis, and the observation that that material had proved difficult to integrated into existing courses. With experts and seasoned instructors from Applied BioMath, we successfully launched a biennial course that assumes no prior knowledge and complements our core curriculum. In informal feedback, students found this course impactful and helpful to their lab work. They appreciated having the basic skills and content linked to real-world project examples. This course also helped one student secure a job post-graduation. (2) The Professional Skills curriculum was motived by our students’ need for training to complement our internship experience and by feedback from industry partners about key skills important for trainees. We identified the need for training in leadership, management, communication, and entrepreneurship. In collaboration with Harvard Business School faculty, the Alan Alda Center for Communicating Science, and the Harvard Biotechnology Club, we are continuing to develop a suite of courses in these areas using didactic modalities that have shown been impactful for our internship program.
Creating Institutional Culture Change to Better Support Deaf Scientists

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The Rochester Postdoctoral Partnership (RPP) is a collaboration between the University of Rochester (UR), the Rochester Institute of Technology (RIT), and RIT’s National Technical Institute for the Deaf (NTID). Funded by the NIH IRACDA program, it seeks to diversify the nation’s biomedical workforce by preparing deaf and hard-of-hearing (D/HH) scientists to pursue independent academic research and teaching careers. A key challenge is that the UR is a “hearing” institution. We have therefore implemented institutional culture change, to better support D/HH researchers. First, we partnered with RIT/NTID, to create collaborative career development programs for D/HH scientists. These include the RPP, an NIH RISE program for undergraduates (at RIT/NTID), and an NIH Bridges to the Doctorate program (at UR and RIT/NTID). Second, we raised the visibility of deaf scientists at URSMD using public relations, web-based and social media approaches - with the goal of drawing more D/HH scientists to UR, while also educating UR faculty about this unique population of researchers. Third, we ensured that D/HH persons are represented in the development of institutional cultural and inclusion programs. Fourth, we improved and streamlined access services, and worked to reduce the social isolation experienced by D/HH researchers, by building community. This approach has: substantially increased the number of D/HH research trainees at UR (from 0 PhD students and postdocs in 2014 to 4 postdocs and 5 students currently); resulted in the launch of a new biannual D/HH science conference that is among the largest of its kind in the nation (DEAF ROC); and enhanced the relationship between UR and RIT/NTID. Nevertheless, several challenges remain. These include the need to: increase the number of deaf faculty at UR; continue to improve opportunities for D/HH persons at all academic levels; and educate hearing faculty on best practices for working collaboratively with D/HH scientists.
Advanced CURE: CURE-based Course Initiated by Students’ Research Questions

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There is extensive effort in higher education to focus the STEM curriculum towards more experiential learning to promote engagement and information retention. To this end, one of the most effective methods is providing an authentic research experience for undergraduate students. Unfortunately, there are challenges for creating an empirical education program that is inclusive, sustainable, and applicable to all college settings. Here, we report an open-ended and team-based curricular research course for second-year college students; called Principles and Practices of Biological Research (PPBR). For the past five years, students in this course have generated an original research question where they formed a hypothesis, designed experiments to test the hypothesis, generated empirical data, then published their findings in a Rutgers-based online journal: https://jbs.camden.rutgers.edu/. This extends the concept of a CURE-based classroom by allowing undergraduates to learn biology through an authentic research experience that is entirely unique and driven by the student’s curiosity. Our curricular research course could serve as a model for increased retention and success among biology students pursuing careers in STEM.
Winston-Salem State University’s Maximizing Access to Research Careers Undergraduate Student Training in Academic Research (MARC U*STAR) Program

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Winston-Salem State University’s (WSSU) MARC Program successfully completed its final year of funding May 2019. The Program was designed to maximize biomedical/biobehavioral research training and to have a broader impact at the Institution. The aims were to 1) introduce students to hands-on biomedical/biobehavioral research; 2) expand the scholars’ professional networks by inviting external speakers in STEM to weekly seminars, and participation in STEM symposiums; 3) foster a career commitment through an experience exemplifying the excitement and challenges of translational investigations; 4) enhance critical thinking skills via an Investigation & Research course; and 5) establish an annual Newsletter to maintain contact with Program alumni, disseminating their successes and the success of the Program to others. The Program had over 20 mentors with primary academic appointments in various STEM Departments at WSSU and Wake Forest University Health Sciences. In the final funding year (2018-2019), 2 of 3 (67%) senior trainees directly matriculated into PhD programs, or MS programs leading directly to PhD degrees in biomedical sciences. The remaining trainee matriculated into a PREP program, with intent to pursue a PhD. A junior trainee did not complete the Program due to funding, but was placed as an NIGMS-RISE scholar. In previous years, the Program leveraged funding to include a parallel cohort of MARC Affiliates who benefited from mentorship activities in funded research labs, without direct financial support. We also collaborated with the NIGMS-RISE program to increase the number of MARC-eligible students via the “RISE to MARC” activities with the lowerclassman, who became eligible for the MARC Program and/or pursued graduate degrees in STEM fields. Overall, the training record included 21 MARC Affiliates and 31 MARC Scholars, with 36/52 (69%) gaining admission into graduate programs and 14/52 (27%) matriculating directly into a PhD program, or within three years after obtaining a Bachelor’s degree.
Seminar Speakers as a Resource for Helping Trainees Succeed in Their Efforts to Become Scientists

Ed Smith, Zac Mackey, Luke Achenie, Robert Browder, Victoria Mukuni and Eni Ramaj

Virginia Tech PREP and IMSD Programs, APSC/CALS, Blacksburg, VA

Recruiting, retaining, and training minorities underrepresented in the biomedical sciences, especially those from underrepresented groups including the economically disadvantaged, African-, Hispanic-, and Native-American groups, continues to be a challenge for the scientific community. Here, we describe an approach that has been a major component of the NIGMS-funded training grants at Virginia Tech that have produced 69 PhDs in the biomedical and behavioral sciences. The video resource, available at our YouTube channel, involve reflections by scientists, including PREP and IMSD alumni, from diverse backgrounds, disciplines, and stages in their careers in STEM fields. The structured retrospectives, around questions that included the importance of family and mentors in their pursuit of science as a career option, provide PREP and IMSD scholars opportunities to use prior experiences of successful scientists to overcome challenges in graduate school and beyond. Our practice of having trainees host speakers, especially nonURM scientists, has the potential to impact any unconscious biasedness that influences the continued lack of diversity in the biomedical workforce. This resource as well as the approach for developing it can be useful to other educational programs interested in recruiting and retaining minorities in STEM.
Creating New Graduate Level Courses for the Postbaccalaureate Research Education Program Scholars

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PREP directors may encounter difficulties in providing PREP Scholars with an opportunity to enroll in graduate level courses at their institutions during the postbaccalaureate training period. Our PREP Scholars in the 2018-2019 cohort attended a sampling of graduate lectures in biochemistry, molecular biology, and genetics, but were unable to enroll, receive a letter grade, or earn graduate credit hours. Feedback provided by our current Scholars included their desires for an opportunity to earn graduate credits. Additionally, we wanted to create a mechanism to embrace motivation and commitment to learning the graduate content. Since the traditional courses offered by the School of Graduate Studies consists of between 2 and 7 credit hours, the typical course load is too large for the PREP scholars to commit, while conducting research and attending GRE preparatory and skills development workshops. Our motivation to create two new graduate-level courses for the PREP scholars was to provide the Scholars with an opportunity to attend biochemistry, molecular biology, and genetics lectures with our enrolled graduate students during the fall and spring semesters and earn letter grades for the embedded programmatic graduate level lectures and transcript, as well as enhance the competitiveness of their graduate school applications. Our approach was to develop a 3 credit hour course, INTER 100-Introduction to Graduate Studies, to be offered in the fall semester and a 2 credit hour course, INTER 101-Introduction to Graduate Studies, to be offered in the spring semester. We recommend that PREP directors work closely with the Dean of the School of Graduate Studies, Registrar, and Curriculum committee, and to budget tuition payments for in-state and out-of-state PREP Scholars. Since our incoming 2019-2020 PREP Scholars cohort will be the first to receive this opportunity, at this time, we do not have measurable outcomes. R25GM121189
Bridges to the Baccalaureate at Purchase College

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Purchase College, State University of New York (SUNY) is partnering with seven SUNY Community Colleges to enhance the diversity of the biomedical/behavioral research workforce by providing successful strategies to increase the number of students from underrepresented groups who transfer to four-year colleges, complete baccalaureate degrees, and enter the workforce or go on to post-baccalaureate work. The Purchase College Bridges Program, begun in 2000, has served 264 students, and has a transfer rate of 80% and a bachelor degree completion rate of 69%. In addition, 28% have gone on to post-baccalaureate work. A number of students who transfer to Purchase College are eligible for the MARC U-STAR Scholarship, which supports their preparation for PhD or MD/PhD programs. Currently a third of our trainees in the MARC Program are former Bridges students. The centerpiece of the Bridges Program is a six-week intensive residential summer research experience. The program begins with a series of workshops focused on skills development, research ethics and experimental design, transferring to a four-year college, ePortfolios, and principles of science communication. Following the workshops, students spend five weeks in the lab or field with a faculty member working on an individual research project. They present their work in two oral symposia and one poster session (judged using the ABRCMS rubric). Several students also present at ABRCMS; in 2018, two students won awards at ABRCMS in Indianapolis for their posters. In addition, the program features a number of community building activities, including barbecues, hikes, a canoe trip, and community college day. Perhaps the most important outcome of the program, in addition to the student outcomes, is the partnership that Purchase has developed with the seven Community Colleges. It has been recognized as a model for two-year to four-year collaboration (2009 PAESMEM Award) and is being replicated across SUNY by the Bridges PI.
Enhancing the Student Research Experience at Queensborough Community College

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Queensborough Community College is an open-admission minority institution that enrolls more than 13,000 degree students (30% Hispanic and 26% black). The majority are low-income, first generation students who come from educationally disadvantaged backgrounds. Our students often have low self-efficacy and misconceptions about research. The project’s goal was to address these issues and enhance student participation in research. Students are inspired and prepared to complete meaningful research projects by a carefully designed scaffold of inquiry and problem-based experiences. A pre-research program consisting of interactive workshops and hypothesis driven hands-on research is offered during winter and summer break. During General Biology I Enrichment Workshops, students work in groups on challenging problems that build content knowledge and cognitive skills. They also attend research seminars by visiting scientists. Workshop students outperform non-Workshop students in combined % A, B, C and mean final grades. General Biology II students participate in authentic genomics research as part of the SEA National Genomics Research Initiative. Bridges students have begun using the web based myIDP to create Individual Development Plans. The myIDP tool helps students identify career goals that match their interests and strengths, and develop a step-by-step plan to reach those goals. Because both mentors and mentees play a crucial role in the success of the relationship, we have introduced formal mentee training. The students learn about mentoring, what their responsibilities will be in the mentoring relationship, and what they can expect from their mentor in return. This evidence-based training will help our research mentees maximize the effectiveness of their mentoring relationships. Ultimately, we want all Bridges students to have this training. Other research students are invited to participate as well. Since 2010, the total number of students engaged in course-embedded research and research programs and has increased from 47 to over 300 per year.
Keeping Our Bridges Program Vibrant for 26 Years by Linking Strategies & Best Practices.

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Our baccalaureate bridges program (ACCESS) has been in place since 1994. It emphasizes four or more aims and these have evolved during the course of our program [Cole 2008]. The overarching goal is to motivate students from our four community college partners to declare a science major ASAP and then transfer to a University of California or California State University institution. The program foundation is built on elements that emphasize student engagement in enrichment activities and catalyze the development of strong academic skills. Core activities have varied over the years [Carneval 2017]. Some successful strategies have included: lab tours, research seminars, Mini Research Camp, and the core Summer Research Institute (SRI). Overall, the outcomes from ACCESS have been spectacular. A few examples include: 7,000 total participants to date, >89% SRI students transferring to four-year academic institutions, and very favorable comments from the 2019 renewal proposal - “Overall this application was rated as exceptional with the potential for high impact.” Our approaches are guided by sharply focused aims (outcomes summarized in the poster). In addition, we have created a multilayered community of scholars and participants which includes >30 UCSC faculty who have pledged to accept ACCESS research students, >12 community college instructors who participate during the academic year and summer, >2 UCSC student participants, and >500 lower-division students. One continuing challenge involves broadening the trajectory of inexperienced community college students away from pursuit of the most obvious biomedical science major – pre-med. We accomplish this via a ‘redirect campaign’ through sustained introduction of the excitement and purpose associated with biomedically relevant majors. We have made ACCESS partially financially sustainable by using augmentation mechanisms including: acquiring institutional commitment to fund UCSC students annually as peer-mentors (priority given to former ACCESS students), outreach to successful ACCESS alums, and successful use of crowd-funding tools.

References:


Brown’s BioMed IMSD program was formed to support growth and stability of a US STEM workforce that draws on and benefits from changing demographics to advance human health and national productivity. Our immediate goal is to increase STEM trainee diversity by 1) Enhancing and expanding strategic partnerships, 2) Implementing a multi-faceted, personalized program for trainees and 3) Transforming institutional culture. Achieving our goal answers the following questions: a) Can institutional partnerships enhance UR student graduate enrollment and success? b) Can elements of personalized student support programming erase gaps in background preparation and enhance academic success in Graduate School? and c) Can increased faculty involvement in interventions and shared goals improve institutional culture and diversity outcomes?’

BioMed IMSD began in the Pathobiology PhD program and expanded to 8 additional programs across the Division of Biology & Medicine (BioMed). It now includes 24 university PhD programs. Here we outline IMSD practices that improve a) student achievement and retention, b) successful post-training placement, c) climate, and d) productive partnerships with minority-serving institutions. These practices build academic and non-academic support and programming scaffolds around students to maximize their success. They also engage faculty as mentors and stakeholders of trainee success. In 2016 BioMed IMSD became the Institutional IMSD program enabling greater dissemination and adoption of best practices and laying a foundation for sustainable institutional change. This new framework unifies and synergizes IMSD programming with new programming / diversity initiatives in the Offices of the Dean of the Graduate School, Institutional Equity & Diversity and Provost. Over the past 3 years, this collaboration has resulted in record numbers of applicants, admitted and matriculating URM PhD and master’s STEM and non-STEM students in the Graduate School’s 131-year history. It has also increased faculty engagement and student engagement and participation of their own learning and education.
Custom Database Solution for Educational Programs to Encompass Marketing, Management, and Collaboration

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Educational training and pipeline programs such as those supported by NIGMS need using a user-friendly but comprehensive database customized to assist program directors and managers. The Loma Linda University Health Disparities and STEM programs for over two decades have supported pipelines and training programs involving students from high school, college, and doctoral levels (1). This effort requires the development of a database solution tailored to manage recruiting, advertising, day-to-day managing operations, and storing information of alumni. We will be describing a database solution customized to manage educational training and pipeline programs. The database solution was developed on the FileMaker platform, is registered under copyright, and offered on a FEDRAMP-compliant cloud hosting solution. The database allows each student to create a personal profile, apply online to one of our programs, and receive notifications. It is also used to evaluate each applicant. Once the evaluation is done, pertinent scores and notes are submitted to the reviewing committee for final determinations. The database is also used to manage the assignment to specific classes, rotation, program evaluation, or other career development interventions. After completing their programs, the students are tagged as alumni, and they continue to have access to their profile where students can update information about their academic, professional development, and to track publications, degrees or job positions. WebDirect facilitates the deploying of the solution online. The ease of customization is what it is attractive about this solution. It incorporates all stages of educational programs and can empower program directors and administrators in making informed decisions regarding the development and implementation of these programs, and customize the individual development plans for each student accordingly.

Reference

Maximizing Program Synergy and Sustainability: A Model for Program Administration at a Large Urban Research-intensive Institution

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A self-study in 2008 recognized that the diverse student body and R1 designation of Virginia Commonwealth University offered a unique opportunity to prepare the next generation of scientists. In 2010, under the leadership of the VCU Center on Health Disparities and a multi-disciplinary team of VCU faculty, four grants were awarded to VCU by NIH/NIGMS/TWDD (MARC, PREP, IMSD, IRACDA). These programs initiated a biomedical/behavioral sciences training pipeline for UR students from the undergraduate to postdoctoral levels. Three programs (PREP, IMSD, IRACDA) received competitive renewals, and undergone successful program director changes due to our unique administrative model. The programs are administered collectively by a steering committee comprised of Principal Investigators and Program Directors from each training program, which meets monthly to discuss joint programming, student issues, and budget allocations from a shared institutional fund. The programs also share internal and external advisory boards allowing maximum input with a minimum burden on time and resources. These programs also share a central program coordinator, evaluator, fiscal and HR administrators, allowing for seamless administrative support for travel, purchasing, HR, event planning, program evaluation etc. In addition, the VCU Bridges to the Baccalaureate program was initiated in 2013 and renewed in 2018. As a result, VCU is currently the only institution in the nation to hold TWDD grants at five levels (community college, undergraduate, post-baccalaureate, pre-doctoral, postdoctoral). Shared structure and communication among all five programs promotes networking among trainees. IRACDA postdoctorals mentor IMSD, PREP and BTB students. IMSD PhD’s present seminars for BTB and IMSD undergraduates, and several mentors simultaneously have trainees at multiple levels. By presenting programs as a united-front at VCU we have garnered institutional resources, creating a pipeline that is more than the sum of its parts. This approach could serve as a model for program synergy and sustainability at other institutions.
RISE – Poster Board #89

Science Exploration Workshop to Identify Budding Scientists Amongst Freshman and Sophomores for Recruitment to NIH RISE BS-to-PhD Program

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Motivation. Historically, many undergraduate students majoring in natural science degrees do not envisage a career as a scientist. This has led to a low number of lower division applicants to our undergraduate NIH RISE BS-to-PhD program. Approach. To attract lower division students who may have an interest in scientific research we developed a one-week Science Exploration Workshop for freshman and sophomores who had completed one biology and one chemistry course with a minimum grade of C in one of the courses and combined two-course GPA of 2.3 (C+). The Workshop introduces students to key principles of the scientific process, scientific ethics, basic laboratory skills, scientific careers, and acquaints them with research-active faculty on campus. Students that complete the workshop are offered the opportunity to rotate through up to three research labs on campus and those who develop a keen interest in obtaining a PhD are encouraged to apply to our NIH RISE BS-to-PhD program. Outcomes. Twenty-five students applied to the workshop and, based on academics, brief statement of interest, and letter of recommendation, 19 were selected to participate. An exit survey suggested that participants had an excellent experience with 100% indicating that they would recommend the Workshop to other students. Ten students elected to continue with the lab rotations and six students applied to the NIH RISE BS-to-PhD program of which four have been accepted--21% recruitment success. The caliber of the four accepted students appears to strong with an average GPA of 3.72. Post-rotation surveys indicated that most students enjoyed their rotation experience. Lessons learned. This early exposure to a structured lab-based science experience followed by lab rotations appears to increase awareness of and interest in PhD careers in science. Student tracking is needed to determine the long-lasting impact of this activity.
Master’s Program Thesis Proposals in the Sciences: Meeting Students Where They Are

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Students enrolled in Master’s programs have variable levels of proficiency in their ability to critique scientific literature, understand the peer-review process, write proposals, and conduct research ethically. These skills are necessary to transform them from consumers of knowledge to creators of knowledge required in graduate work. The Cal State LA RISE Foundations in Research Project is a five-year, equity-minded course-redesign project designed to provide students enrolled in biomedically-related Master’s programs with skills needed to complete high-quality thesis projects in a timely manner. The project was launched with evaluation of CHEM 5100 and BIOL 5200, courses designed to help students develop their MS thesis proposals. Course instructors have discussed the selection of course activities, the quality of research plans produced, and additional steps to improve the courses. Students were surveyed to assess how the courses have helped them develop as scientists. This paper will discuss the design, progress, and current results of the Foundations in Research project.

References:


Backwards Design of a New RISE Program

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The Sacramento State RISE Research Program was founded in 2017 with the aim of increasing the number of underrepresented undergraduates who pursue PhD degrees biomedical research. Backwards Design was used to align the desired outcomes, the learning goals and the learning activities for the program. The desired outcomes are (1) to get participants into PhD programs and (2) to prepare them to succeed in PhD programs. Towards this end, we identified four overarching learning goals: (1) Develop a STEM identity, (2) Professionalization, (3) Develop interpersonal Skills, and (4) Develop practical research skills. These learning goals were deconstructed, and activities were identified to facilitate participants’ attainment of these goals. This enabled the construction of a robust program. Revisiting the learning goals and activities after the first year allowed us to identify holes in our program, and we developed activities to address those holes. These include (1) mentoring research mentors and (2) monthly meetings of all RISE participants to present their ongoing research to each other.
Assessing the Impacts of RISE Program Involvement using a Novel Peer Comparison Group

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The University of North Carolina at Pembroke is a state-supported Masters-level liberal arts minority-serving regional institution in southeastern North Carolina. In order to better evaluate the efficacy of program activities and improve implementation through making evidence-based changes, the RISE Program at the University of North Carolina at Pembroke compares outcomes between RISE Fellows and a non-RISE peer group of students enrolled in STEM independent research courses. For programs like ours (undergraduate RISE), selection of an appropriate comparison group(s) may be a critical factor in assessing the effects of our intervention activities. In order to be useful, the comparison group must be readily targetable/accessible for data collection, and members of the groups being compared should be well-matched in terms of race/ethnicity, gender, academic prowess, undergraduate major, initiative (i.e., willingness to engage in research as an undergraduate), and level of mentor engagement. The students enrolled in independent STEM research courses at UNCP are well-matched with the RISE Fellows in terms of academic factors (GPA, time spent studying, etc.) as well as demographic factors (race, gender, etc.) which bolsters claims about the impacts of the RISE program activities since inclusion/exclusion from these activities is the most significant difference between the two groups.

A survey aimed at examining the attitudes, beliefs, behaviors and career goals of UNCP RISE scholars (n=49) versus undergraduate students at UNCP who performed mentored research for course credit but were not exposed to the full RISE experience (n=68) was administered annually to both groups. Analysis of the responses shows that RISE Fellows are more likely to have closer engagement with and support from STEM faculty and feel more comfortable discussing and preparing to present their research findings. In addition, of the surveyed UNCP STEM graduates who matriculated into STEM graduate programs (n=20) between 2014 and 2018, 75% were RISE Fellows. We find that this specific comparison group strengthens the conclusion that RISE Fellows were more motivated and/or better prepared to enter graduate studies than their research-participating peers.
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IPERT – Poster Board #17

IMERS: Interactive Mentoring to Enhance Research Skills Grant-Writing Workshop for Faculty at Institutions with Significant Enrollment of Underrepresented Minorities

Brett T. Spear¹, Kathy Grzech¹, Barbara Duncan¹, Sean Scott¹, Ada Sue Selwitz¹, Margot D. McCullers¹, Terry D. Stratton¹, Ok-Kyong Park-Sarge¹, M. Paul Murphy¹ and Donald T. Frazier¹

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The overarching program goals of the Interactive Mentoring to Enhance Research Skills (IMERS) workshops, supported by an IPERT R25 grant, (GM0125680) are (a) to empower faculty at minority-serving institutions (MSIs) in their efforts to develop and submit competitive biomedical research proposals through intensive grant-writing skills training; (b) to build research-related individual and institutional capacity through training on the mentorship of student researchers; and (c) to sustain workshop momentum by embedding multiple levels of individualized mentored proposal development support during and after each workshop. This program is a continuation of a long-running series of NIH-funded training events led by Dr. Donald Frazier for over twenty years. The IMERS program is comprised of two on-site grant-writing retreats held on the University of Kentucky (UK) campus and three off-site regional workshops each year. On-site workshops (~25 attendees/event) are designed for highly motivated investigators who have submitted proposals to NIH without success and those who are actively planning NIH submissions. On-site workshops include consultation with actively funded UK investigators and UK Proposal Development Office staff. Post-workshop interactions between participants and UK faculty/staff are facilitated via a community listserv. The off-site workshops are targeted to faculty who are actively engaged in writing/submitting grants as well as to faculty new to NIH with an active interest in biomedical research. Workshops sessions cover a range of evolving topics including: Using NIH resources for program and funding information, pre- and post-award budget issues, the proposal review process, writing a high-impact specific aims page, writing an effective research strategy, rigor and reproducibility, responsible conduct of research, what to include in the NIH biosketch, navigating the NIH resubmission process, and how to effectively mentor and train student researchers. Workshop effectiveness is evaluated from application materials, workshop surveys, and post-workshop follow-up questions and is being continuously refined to address investigator needs.
Researchers’ recurrent struggles to compare and reproduce published research results prompted the primary federal funding agencies (e.g., National Institutes of Health [NIH], National Science Foundation, etc.), scientific journals, press and ethic integrity forums, among others, to discuss scientific experiments’ rigor and reproducibility as key factors in credibility of research, and, therefore, as essential elements in teaching and training future scientists. NIH was one of the first agencies to develop a set of guidelines to assure scientific integrity through rigor and reproducibility. The guidelines focus on the rigor required in four areas: reviewing the strengths and weakness of prior research and in developing the scientific premise; developing a research design based on the scientific method to achieve “robust and unbiased” results; delineating and explaining relevant variables such as, for example, sex, age, etc. that could make a difference in the outcomes; and, authenticating and validating chemical and biological reagents.

In view of NIH guidelines, we determined to promote scientific integrity, accountability, and responsibility in imaging science by developing and using a training module in rigor and reproducibility. In the summer of 2018, the module was used in a University of Kansas course for young scientists (i.e., undergraduate and graduate students, post docs, and others). The training module was designed to enable current and future scientists to master metabolomics, structural biology and imaging technologies as well as to authenticate, validate, and replicate data generated. The training module focused on didactic training in Responsible Conduct of Research (RCR) and the applied aspects of RCR, specifically the “hard” and “operational” aspects of metabolomics, structural biology, and imaging technologies used in design and experimental execution, data acquisition, curation (i.e., bioinformatics), quantitation and interpretation. The goals of the course were to: 1) contribute to developing a diverse pool of well-trained scientists; 2) increase skills required for rigor and reproducibility; and 3) promote diversity, inclusion, and responsible conduct. Course participants were at different points in their research careers, from undergraduate students to early career faculty. All were from an underrepresented group, based on their gender, race, or ethnicity. Student evaluation of the course was completed through a survey tool, with a response rate of 90 percent. Overwhelmingly, this course met participants’ expectations and they left with a better understanding of rigorous research practices, including how to apply several advanced technologies to their research projects, and how to effectively collaborate with other research groups.

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Development of Curricular Activities in Rigor and Transparency to Enhance Reproducibility

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We restructured and expanded a graduate-level experimental design and data analysis course to include the principles of scientific rigor and research transparency, in order to address our duty to public accountability and social responsibility in the conduct of science. The course is fully online, and it emphasizes the importance of understanding the rationale for each experiment, instead of the mechanics of statistical analysis. Trainees are stimulated to shift from a “boilerplate” approach to experimental design and data analysis, to a more critical mindset in which each individual experiment is carefully justified and designed, with a clear understanding of the strengths and weaknesses of the chosen approach. The planned curriculum will enhance the ability of training biomedical scientists to strengthen the scientific premise and rigor of their independent projects. Once the course is implemented and evaluated locally at the University of Kentucky, we will extend access to users elsewhere.
T32 Predoctoral – Poster Board #26

Development of a New Clinical Translational Research Certificate of Added Qualification (CTR-CAQ) Training Program at Baylor College of Medicine

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We have successfully trained PhD students in Translational Biology and Molecular Medicine (TBMM) since 2005 in a graduate program (supported by Molecular Medicine T32 GM88129) that combines foundational course work and thesis research with dedicated human disease-oriented and translational research courses, and experiential learning in translational clinical research under guidance of a clinical co-mentor. This training was offered in only one of 12 PhD graduate programs. Within the context of a school-wide strategic transformation effort to modernize graduate education at Baylor College of Medicine, we recognized the need for a program that offers training opportunities in clinical and translational research to all graduate students. We therefore developed an innovative Clinical Translational Research Certificate of Added Qualification (CTR-CAQ) program with a rigorous two-year curriculum, in which students can enroll during their second and third years in graduate school. It is designed to integrate with the education students receive through their primary graduate programs. The curriculum combines course work, small-group workshops and clinical translational research experiences. The program will emphasize teamwork, rigor and ethics in clinical research, as well as professional skill development with a focus on leadership of clinical research teams. Outcomes will be followed through measuring completion rates, retention in the CAQ, and post-graduation engagement and retention in translational research, in comparison to students not enrolled in the CTR-CAQ program, along with faculty and student surveys. We anticipate that this novel program will benefit recruitment and retention of graduate students at BCM, provide much needed training of graduate students in translational research and promote inclusion of students from underrepresented groups in science in translational research careers.
A T32 Supplement to Drive Advanced Training in Biostatistics and Acquisition of Practical Skills in Using R for Biomedical Graduate Students

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Keywords: reproducibility, bioinformatics, biostatistics, experimental planning, R

In 2015, the long-standing T32 to support the Training Program in Genetics at Emory University, which is seated within the Graduate Division of Biological and Biomedical Sciences (GDBBS), was awarded a supplement to support the development of a course in Biostatistics. With this supplement, we initially developed a new statistics course for biomedical PhD candidates from all of our T32-supported programs with four broad learning objectives: 1) to work with increasingly sophisticated experimental and exploratory data analysis and data visualization relevant to biomedical research, using R software; 2) to gain deeper experience in planning and performing appropriate statistical analysis given a variety of experimental design scenarios; 3) to understand the philosophical and historical underpinnings of the scientific method and their relationship to data exploration and statistical inference; and finally, 4) to be positioned to undertake an advanced bioinformatics course. The course was structured using two pedagogic practices within each class meetup elements (guided discussion and practicum). A highlight of the term was a session on forensic bioinformatics and the notorious Anil Potti case by Kevin Coombs as guest lecturer. Dr. Coombs also gave well-attended open lecture entitled, “Cell lines, chemotherapy response and the need for reproducible research”. The students were surprised to learn the degree by which sloppy handling of the primary data underpinned this case, which was the basis for a major clinical trial. Although the course offered a variety of conceptually sophisticated biostatistical and computational concepts that are foundational for bioinformatics, including multivariate regression, permutation analysis, GLM and network analysis, the class discussions frequently returned to the fundamental problems of finding unbiased ways to approach experimental planning, data handling and its visualization. One outcome was realizing the difficulty by which students view traditional statistical power analysis as a pre-planning tool. A solution derived from the class joins statistical tests most commonly used in biomedical research (e.g., t-tests and ANOVA) with more sophisticated permutation analysis (Monte Carlo) as used in bioinformatics. The resulting hybrid calculations yields both important experimental previsualization and a power calculation. This advanced analytics course served as an incubator for one of the instructors to master and optimize the teaching of R. Teaching biostatistics in R is very important because a) it is such a comprehensive tool that unleashes those who want to embrace it, and b) that forces people to really understand the statistical analysis. This supplement was critically important because now ~120 of our PhD students have participated in this resulting course. Previously, only those very few students who take analytics and bioinformatics would have been exposed to the R based statistical learning approach. The replicate the success at Emory (https://tjmurphy.github.io/jabstb/). We are now collaborating to extend the impact of this supplement by using a biostatistics course as the mechanism to bring together a broad cohort of GDBBS students across eight graduate programs.

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Interdisciplinary Biostatistics Research Training for Molecular and Cellular Sciences: Enhancing Rigor and Reproducibility

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Graduate students in the life sciences and engineering are increasingly tasked with analyzing complex quantitative experimental data while lacking a strong foundation in statistical approaches. General statistics courses focus largely on theoretical considerations of how the statistical tests are derived rather than on application, and tend to be taught using examples that are seldom suited to biological, chemical and engineering data. Accordingly, students sometimes find it difficult to connect statistical concepts to the specific statistical tests that they need in order to analyze their data. A T32 supplement through NIGMS provided us with the opportunity to develop a modern and relevant 3-credit biostatistics course with a strong foundation in data analysis. Lectures were reinforced by specific and practical examples, as well as laboratory exercises using data generated in class or in students' laboratories as part of their thesis projects. The course has been offered for three consecutive years with enrollments of 25-30 students per year. The course has been well received by students who generally evaluated the course with comments indicating that the curriculum made the material accessible and developed an appreciation of the importance of statistics in establishing research credibility. In the second and third years, the course was modified to include more hands-on exercises and assignment of more articles for evaluation of statistical methods. The course will be offered as a permanent component of the NIH Biotechnology Training Program and the Biomedical Engineering (BME) graduate program.
Design and Implementation of a Course in Rigorous Experimental Design

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Motivation: The goals of this work were to 1) determine the amount and sources of graduate students’ knowledge of rigorous experimental design and 2) develop a course to teach these principles.

Approach: A curriculum for biomedical graduate students focused on rigorous experimental design has been under development since 2016. At the start of the course, students were presented with a survey of their basic knowledge concerning experimental design, the sources of this knowledge, and related behaviors.

Outcomes: Prior to course enrollment, the students’ potential sources of knowledge included journal clubs, other courses, and their mentor. Most students were presented with information about formulating hypotheses relatively frequently (56%, 74%, and 96% for journal clubs, courses, and mentors, respectively). In other areas, however, prior exposure was lacking. For example, one-third of respondents said either that they did not know what internal validity and external validity are or that they did not recall these topics having been discussed previously. Also, 53% of respondents indicated that they had discussed the positive and negative controls in relation to their own research at least five times in the preceding six months, but 21% of respondents had not discussed these topics at all during that period. Regarding data management, 89% used electronic recordkeeping exclusively or sometimes, 63% reported that all members of the study team could access original data, and 37% had backed up their data in the previous week. We developed a comprehensive course to address these and other deficiencies.

Lessons learned: These data highlight a severe deficiency in the current model for training for training in experimental rigor and reproducibility. By continuing this evidence-based educational approach, we anticipate that this curriculum will help to educate the next generation of science in appropriate aspects of the scientific method and build a renewed confidence in scientific inquiry.
Design and Dissemination of New Lab Safety Training and Awareness Modules

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The need for effective training in laboratory hazard awareness and accident prevention continues to increase. In order to instill a culture of safety for our graduate trainees and diminish the incidence of accidents, we developed didactic lab safety training material that is thought-provoking, interactive, and motivational. We built discussion based training modules that include video case studies acted out by first year graduate students, lab based demonstrations, written case studies with discussion, informational slides, mindfulness moments, and opportunities to develop checklists within each safety topic. We encourage practice of mock lab incidents as a way to promote accident prevention and appropriate emergency response. The modules we created address topics such as needle stick prevention, safe chemical handling, fire hazards, and general lab safety awareness training in equipment safety, UV safety, emergency response, incident reporting, proper handwashing technique, slip/trip/fall hazards, and much more. The material is designed to be interactive and engaging. We learned that awareness and prevention training presented with a cognitive approach can provide students with a long-lasting appreciation for maintaining a culture of laboratory safety. Creating these modules involved much effort but proved to be a great way to engage students in safety awareness and to receive feedback on safety training topics that were not adequately addressed. The training modules and handbook are publicly available on our program website (http://www.lerner.ccf.org/mmed/) and freely available to other academic training programs and research labs. Funding for development of these modules was provided by an administrative supplement on Lab Safety to our Molecular Medicine training grant (T32 GM 088088 S1) funded by the NIGMS.
Online evidence-based course design to expand reach of rigor and reproducibility curriculum

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Motivation: JPA Ioannidis published the initial article (viewed over 2M times and cited more than 2,500 times) bringing renewed attention to research integrity and reproducibility. Fourteen years later, although improvements have been made, additional resources are needed to educate the next generation of scientists about these same principles. Approach: To expand the impact of an in-person curriculum developed at Vanderbilt University by Dr. Bruce Damon, we began construction of an asynchronous online course using evidence-based approaches. The course integrated NIH videos and discussion material, as well as Office of Disease Prevention online course materials. Additional elements were added to increase on online course engagement and maximize impact including discussion boards, online quizzes, and video-assignments. Additionally, we used a Quality Matters rubric during online course development. Outcomes: We have completed construction of the online course and will launch an internal pilot in July 2019. The primary outcome of this process was a new educational resource that can be used by all interested institutions. The results of the pilot will be discussed during the poster presentation. We plan to launch this course as an open resource in August. Lesson learned: There are many challenges facing science including retaining public trust. Through evidence-based approaches, this course can help educate the next generation of science and build a renewed confidence in scientific inquiry.

The Graduate Program in Molecular Biology, Cell Biology & Biochemistry (MCBGP) at Brown University has recognized that training for predoctoral students in scientific rigor and reproducibility is essential for student success and the advancement of biomedical research. We have identified four key questions bearing on rigor, reproducibility, and transparency that graduate students will learn to address: (1) What is the scientific premise of the proposed research? (2) Are the student's proposed experiments rigorously designed, with statistical analysis planned from the outset? (3) Have the relevant biological variables been considered? (4) Does the research include authentication and validation of key biological and/or chemical resources? In 2016 we designed a set of modules for training in rigor and reproducibility (R&R), with development and implementation of these modules funded by NIGMS as a supplement to T32GM007601. After these modules were piloted by MCBGP first-year students in 2016-2017, feedback from both trainees and faculty indicated that some, but not all, modules were appropriate for early-stage trainees. Those modules: Experimental Design, Team Science, and Analysis of Published Methods and Data are now required for our trainees during years 1 and 2, and are offered to all predoctoral students in the Division of Biology & Medicine at Brown University. Our work to develop R&R training also revealed that many of these training activities are ineffective unless imbedded in a rich context such that training interfaces with the students' critical reading of the primary literature, and/or experimental design and research goals. R&R training activities have now been incorporated into our required coursework and training activities. Importantly, these activities begin during the first year, and continue throughout the training period.
The Health Sciences Entrepreneurship (HSE) Boot Camp is a residential training program initially funded by an NIGMS T32 training grant supplement T32GM106999-04S1 in 2016. The HSE Boot Camp has three primary goals: 1) enhance the breadth of career development activities to prepare students for the biomedical workforce; 2) support educational activities that complement traditional training by increasing awareness of entrepreneurial activity and the potential to commercialize ideas to improve health outcomes; and 3) reinforce the practice of team science as a mechanism for health science innovation. The Camp, currently funded through Arkansas INBRE, is an all-expenses-paid five-day training program in which students learn how to start and fund a startup, meet with potential investors, and become exposed to regulatory requirements, patents and legal issues. Student teams create and refine new venture ideas and interview potential customers. The first Camp was attended by fourteen graduate students in August 2016. Two participants from this cohort founded health science related startup companies within twelve months. A second Camp was conducted in May 2017. Twenty students from ten different campuses in the State of Arkansas attended it and two teams progressed to the 2018 Donald W. Reynolds Governor’s Cup collegiate business plan competition. One team won first place in the innovation division and the second team won the $25,000 top prize. A third Camp was held in May 2018, with seventeen students from ten different schools. Recently, the Boot Camp earned a second place Innovations in Research and Research Education Award from the Association of American Medical Colleges. Diversity data are collected and compared to evaluate effectiveness in recruitment. Of the 51 total students to date, 53% were female, 25% were African-American, 10% were Hispanic and 8% were Asian. To date, we have enrolled students from 15 different colleges and universities across Arkansas.
Developing Training to Enhance Rigor and Reproducibility

Tori Sharma, Ph.D. (Department of Research Administration and Compliance, UC Berkeley), Christopher J. Chang, Ph.D. (Departments of Chemistry and Molecular and Cellular Biology, UC Berkeley) and Matthew B. Francis, Ph.D. (Department of Chemistry, UC Berkeley).

All Berkeley Chemical Biology, Molecular and Cell Biology, Neuroscience, and Biophysics graduate program students are required to take MCB 293C (Responsible Conduct in Research and Research Ethics) during their 1st year. To address training in rigor and reproducibility, we initially expanded this 5-week required course to 10 weeks in the Spring of 2017. Students were first polled for their interest and ability level on multiple topics. In response, we introduced curricula covering data management, experimental design, data collection and recording, and image analysis. A set of three interactive sessions discussing statistical data analysis and reporting was also developed. Lectures were recorded via course capture and have been made available along with all course materials on the course website. Regular in-class student evaluations were collected. The course website, instructor website, and digitized student evaluations were made available to the curriculum advisory board, comprising faculty who are currently training grant PIs at UC Berkeley, for their evaluations and recommendations. We identified several improvements which we have implemented over the course of the 17/18 and 18/19 academic school year. The curricula are now a separate course required in the first semester for the above graduate programs as MCB 293D (Rigor and Reproducibility in Research). Changes to MCB 293D include a broader use of multimedia training tools and additional topics such as cell line authentication and institution specific data management training. A separate course covering statistical analysis will also be required for students entering the 19/20 academic school year. Additional sections of MCB 293D are also being developed to address the post-doctoral fellow population.

Keywords: reproducibility, rigor, research ethics, ethics training
The goal of this T32 Administrative Supplement Award (GM066699-1S1) is to provide training in effective oral and written communication skills for Rockefeller University’s graduate students, highlighting how these skills are leveraged in diverse careers for biomedical PhDs. To accomplish this objective, we have designed a new series of initiatives focused on the best approaches to effectively convey scientific concepts to a variety of audiences. In addition to providing specific strategies and practices for developing effective written and verbal communication skills, we also introduced students to non-academic career paths for which strong science communication is most essential, and provided opportunities to develop their knowledge base and network in these areas. In Part One of this series, we focused on engaging technical audiences, and offered modules on “Effective Writing by Scientists for Scientists”, “Making the Most of Oral Presentations”, and “Editorial Perspectives on Scientific Writing”. We also highlighted “Careers in Scientific Publishing and Editing” through a 5-day mini-course. Part Two - “Making Science Accessible” – has included courses on “Exploring Science Journalism” and a “Teaching Story Telling Skills to Scientists” workshop, led by science journalists and science advocacy and policy professionals. Overall, the opportunities supported by this award have successfully enhanced the ways that we are developing the communication skills of our graduate students. This support has also expanded the view of how scientists can make significant contributions to the biomedical workforce beyond the research bench.
Workshop in Rigor and Transparency to Enhance Reproducibility for Bioinformatics Graduate Students

Maureen Sartor, Peter Freddolino, Amy Pienta, Margit Burmeister, Brian Athey

University of Michigan: 1) Computational Medicine & Bioinformatics, 2) Biostatistics, 3) Biochemistry, 4) Populations Study Center and Inter-University Consortium for Political and Social Research, 5) Psychiatry, 6) Molecular & Behavioral Neuroscience

In the past few years, the failure of basic biomedical science to be reproduced in the best equipped laboratories was a truly stunning finding that needed to be addressed. As the world of biomedical research has gone to fully digital data, how can we best ensure our students can keep up with best practices of handling digital data if we don’t give them a strong foundation to build from? Our students training for a PhD in Bioinformatics on the Bioinformatics Training program (BITP), an interdisciplinary graduate training program in bioinformatics and computational biology, drawing >115 faculty from the Schools of Medicine, Engineering, Literature, Sciences and the Arts (including Departments of Mathematics, Statistics, Chemistry, and Physics), Public Health, Nursing, Pharmacy, and Information.

To address this challenge, we developed a 5-day training workshop in Rigor and Transparency to Enhance Reproducibility to assist graduate trainees in developing their expertise and data management workflows that follow best practices for documenting and sharing research methods and data—not just results. For this workshop, we partnered with the Inter-University Consortium for Social and Political Research (ICPSR), who are renown world-wide for their expertise in policies and practices regarding data sharing, data management, data and code curation, information security and privacy practices, data stewardship, and open science.

The workshop ran 5 days full time, intermixing computational exercises with didactic lectures. The first day of the workshop covered rigorous study design - including authentication, power, statistical and blinding considerations, with the subsequent days dealing with data QC, processing and sharing, best practices to document and share code, following FAIR principles (findable, accessible, interoperable and reusable), ending with dissemination, including use of social media.

This course was obligatory for bioinformatics students in early years. Evaluations by students were excellent, especially given that participation was obligatory. It was particularly rewarding to see that while students were initially not very interested in the topic - >30% had no strong desire to take this course (score 1-2), and 42% a moderate (3) desire), after the course, >70% agreed afterwards that their interest in the topic had increased.

We will offer this workshop again in 2020, The first day of the workshop on rigorous study design will be opened to the wider Michigan Predoctoral student community, while days 2-5 are useful for BITP students who know how to program and deal with large datasets.

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Sustainability of Best Practices: The Long-Term Impact of the MARC U*Star and RISE Programs at CSU Long Beach

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The CSULB MARC U*STAR and RISE programs have long focused on impacting participants’ development of research training and lab skills, as well as knowledge and awareness of graduate school and biomedical careers. In an effort to support program sustainability and institutionalization, CSULB’s Center for Evaluation and Educational Effectiveness (CEEE) conducted a longitudinal analysis to determine the impact of the programs over time. Using a mixed-methods approach, CEEE analyzed student data, faculty mentor data, and analyzed documents to assess synergies and impact.

Findings demonstrate participants greatly benefit from both MARC and RISE programs. Students report they received valuable training and support from faculty, and from the programs as a whole. Both programs have a positive effect on academic and research skills, confidence, and science identity. Students consistently point to the small cohort sizes and one-on-one faculty interactions as a component that has provided benefits such as relationship building and the development of a necessary support network. Participants cited the programs as providing them with the preparation needed for graduate school applications and an understanding of graduate school expectations. The ability to practice research presentations, discuss challenges with peers and faculty, and learn from alumni have all been activities cited as having an impact.

Sustainability & Institutionalization
The evaluation examined both significant synergies and differences between programs to support possible institutionalization of components. Any component moving forward for institutionalization should inhabit these characteristics:

- Small cohort models
- Faculty mentors who provide guidance through individualized plans
- Professional development workshops and group meetings tailored specifically to students needs and goals
- Appropriate levels of challenge met with support
- Common evaluation focus & data sources

Both programs continue to be highly effective at providing underrepresented students with skills, resources, confidence, and overall enthusiasm necessary to pursue careers in research and sciences.
Sustaining Long-Term Collaborations Between a Tribal College and a Research Institution

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American Indian/Native Alaskan students are one of the most underrepresented groups in behavioral/biomedical research. Haskell Indian Nations University and the University of Kansas, both located in Lawrence, Kansas less than two miles apart, have maintained a long-lasting collaboration to enhance science training for those students. Haskell is one of only two tribal colleges in the United States operated by the Bureau of Indian Affairs, whose charge is to serve all 570+ federally recognized tribes from across the United States. The University of Kansas is a “Highest Research Activity Doctoral University” according to the Carnegie classification of institutions of higher education and the only Association of American Universities institution in the state of Kansas. With the support of NIGMS, over the past 20 years, the BRIDGE, IMSD, and PREP programs have changed the paradigm for building diversity in science training at the University of Kansas. We have gained the necessary knowledge and developed the required infrastructure that allowed for the successful development of research collaborations between our two institutions. The NIGMS funded programs have demonstrated that it is possible to recruit and successfully train American Indian students in biomedical research disciplines while serving the missions of both institutions. We will discuss the experiences from our long-term collaboration, the outcomes, and the elements that have made it sustainable over the years.
PREP – Poster Board #66

‘Mini-thesis’ meetings enhance PREP scholar training and expand faculty involvement in PREP

Katherine L. Wilson¹

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Hopkins PREP (Postbaccalaureate Research Education Program) piloted and implemented a new activity, Project Meetings, with our 2018 cohort. We wanted PREP scholars to learn how to organize their own ‘brain trust’ of scientific advisors, and gain confidence by discussing their research for an hour with a small group of faculty, three times during their first year. Project Meetings are ‘mini-thesis’ meetings. Scholars introduce themselves to two subject-expert faculty and ask them to serve on their Project Committee, in addition to their PI and PREP director. Most scholars start in June; and Project Meetings are held in early September, Nov/Dec and May/June. Scholars write a brief (~3 page) research summary and proposal with input from their PI, send it to their committee and then present it via powerpoint as part of a one-hour discussion with their committee. These meetings provide insight about the scholar’s level of understanding of their project, any communication or professional skills they may need to improve, and the quality of the scientific mentoring and training environment. The first Project Meeting for one scholar revealed an unsuitable training environment, prompting swift transition to a different lab where the scholar flourished. Another scholar, frustrated by irreproducible results, was encouraged by the committee’s lively debate about the pros and cons of alternative strategies. As with PhD thesis meetings, the research mentor is personally accountable— to their scientific colleagues and the PREP director— for their scholar’s project and improving their communication skills. Scholars benefit scientifically and professionally by getting to know and interact with two more faculty. Notably, several PREP scholars received an independent letter of recommendation for their graduate school applications from one (or both) of their outside committee members. We will track our scholar’s views of this experience going forward. Our PREP is now entering its 5th year. Of the 23 scholars who have applied so far, 95% entered rigorous PhD or MD/PhD programs within two years of starting PREP. All five 2018 scholars are entering rigorous PhD programs after their first year of PREP. We hope our Project Meeting ‘veterans’ will welcome (not fear) engagement with future PhD thesis committees. One further benefit, obvious in hindsight, is that Project Meetings literally tripled the number of faculty who personally engage with PREP scholars each year, enhancing faculty awareness and willingness to participate in PREP.

(https://www.hopkinsmedicine.org/som/Opportunities-High-School-Undergraduate-Postbac-Students/prep.html)
The VCU (Virginia Commonwealth University) Bridges to the Baccalaureate Program, with partners Thomas Nelson Community College (TNCC), and John Tyler Community College (JTCC), was initiated in 2013 and awarded a competitive renewal in 2018. This integrated student development, teaching, learning, and research training program addresses disparities in the preparation, persistence, and success of STEM transfer students from underrepresented (UR) groups, with the longer-term goals of increasing the number of UR STEM students who continue education at the graduate level and enter careers in the biomedical/behavioral sciences. Our program has facilitated transfer student preparation and persistence by: 1) enhancing advising, 2) developing two “hands-on” molecular biology courses, and 3) developing a quality summer research program for talented UR community college students. Partial salaries for the first FT STEM-H adviser at TNCC and the first FT Biology adviser/coach at VCU were partially funded; both positions were institutionalized in 2018. Joint STEM advising meetings have led to more integrated curricula, and defined course equivalencies and recommended course plans for prospective transfer students. Transfer agreements have been forged or improved. The two “hands-on” courses are directly-transferrable and economically sustainable; both were co-developed by VCU, TNCC, and JTCC instructors and are taught at all three institutions. The VCU BTB Dream-to-Goal (DTG) Summer Research Program has trained 92 students. Of these, 30 have “bridged” to 4-year institutions, 28 have completed AS degrees, five have transferred to IMSD programs, 10 have completed BS degrees, two have matriculated to PREP programs, and one has matriculated to a PhD program. Finally, knowledge gained via this program provided the foundation for the recently funded VCU-HHMI Inclusive Excellence Program which focuses on larger administrative changes to facilitate the success of all VCCS transfer students at VCU.
The EmpoweRU Student Coaching Program was born out of the recognition that students entering graduate school face daunting challenges that may jeopardize their future success and cause considerable stress and anxiety. Last year, we piloted a small program restricted to the multi-disciplinary graduate program on campus. We recruited six 2nd year graduate students, who excelled in their first year of graduate school and trained them as “Student Coaches.” Coaching is the process of using deep listening and powerful questions to support coaches in finding solutions to their problems. Student coaches met with five to six 1st year students once a week the first month of graduate school and every three weeks afterwards. Topics addressed by the Student Coaches included: study strategies for different courses, setting up study groups, finding a rotation, and even how to write an email to a faculty member. Concurrently, we also offered EmpoweRU Workshops, run by Dr. Loren Runnels, which covered strategies for coping with stress and anxiety, goal-setting, and effective personal communication. The workshops offered another forum for students to get individual support on a range of issues. Overall the EmpoweRU Student Coaching Program was highly successful based on anonymous surveys. Students reported that they felt strong support from their student coaches. The program also helped them students to form social connections with other students as well as develop strategies for coping with their challenges. Students who needed help mitigating stress and anxiety because they were facing more severe academic challenges reported feeling substantial relief and support from interactions with their student coaches. We learned that students benefit from supportive relationships with student coaches and trusted faculty. Importantly, the EmpoweRU Student Coaching Program fosters a culture of support where students are empowered to stay on course to discover and realize their academic and professional potential.
Addressing touch points within the academic pipeline: Ensuring student success through pipeline continuity

Bloom BE, Chavez TC, Bernstein S, Maloy S, Atkins C and Tong W.

Problem: There is a lack of continuity in programming for underrepresented minority (URM) students from the point of entry into the university as a freshman or transfer student to their baccalaureate completion and transition to graduate school.

Addressing the Problem: We have addressed this lack of continuity for URM students through relationship building to reinforce our existing pipeline structure, which includes local high schools and community college programs (e.g., BRIDGES), pre-research prep programs (e.g., Pre-MARC, Pre-IMSD, CSU-LSAMP), research intensive undergraduate programs (e.g., MARC, IMSD), and a post-doctoral program (IRACDA). We reinforce the pipeline by increasing the number of touch points for students within the pipeline, utilizing a “footsteps” model and tailoring opportunities for students who have not yet entered the pipeline.

Outcomes: Our approach has improved student success, and ensured continuity of program support, and mentorship. SDSU IMSD and MARC undergraduate students obtain acceptance into PhD programs at rates higher than the NIH Program goals regularly. Feedback from students at each step of the pipeline also provides qualitative evidence that multiple touch points enhance academic success.

Lessons Learned: Building tight links among support programs provides continuity to URM students as they traverse the higher education pipeline. Collaborating across disciplines and programs allows us to guide students in a variety of ways, relying on the unique strengths of different programs. We have created a “footsteps” model, where we provide a clear pathway for students to step from point to point within the pipeline. While sustainability depends upon continued funding from the NIH and NSF for student support, institutional support for program staff enhances student experiences. We disseminate this information through presentations, our campus website, and regular communication among programs within our pipeline.
Maximizing Program Synergy and Sustainability: A Model for Program Administration at a Large Urban Research-intensive Institution

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A self-study in 2008 recognized that the diverse student body and R1 designation of Virginia Commonwealth University offered a unique opportunity to prepare the next generation of scientists. In 2010, under the leadership of the VCU Center on Health Disparities and a multi-disciplinary team of VCU faculty, four grants were awarded to VCU by NIH/NIGMS/TWDD (MARC, PREP, IMSD, IRACDA). These programs initiated a biomedical/behavioral sciences training pipeline for UR students from the undergraduate to postdoctoral levels. Three programs (PREP, IMSD, IRACDA) received competitive renewals, and undergone successful program director changes due to our unique administrative model. The programs are administered collectively by a steering committee comprised of Principal Investigators and Program Directors from each training program, which meets monthly to discuss joint programming, student issues, and budget allocations from a shared institutional fund. The programs also share internal and external advisory boards allowing maximum input with a minimum burden on time and resources. These programs also share a central program coordinator, evaluator, fiscal and HR administrators, allowing for seamless administrative support for travel, purchasing, HR, event planning, program evaluation etc. In addition, the VCU Bridges to the Baccalaureate program was initiated in 2013 and renewed in 2018. As a result, VCU is currently the only institution in the nation to hold TWDD grants at five levels (community college, undergraduate, post-baccalaureate, pre-doctoral, postdoctoral). Shared structure and communication among all five programs promotes networking among trainees. IRACDA postdoctorals mentor IMSD, PREP and BTB students. IMSD PhD’s present seminars for BTB and IMSD undergraduates, and several mentors simultaneously have trainees at multiple levels. By presenting programs as a united-front at VCU we have garnered institutional resources, creating a pipeline that is more than the sum of its parts. This approach could serve as a model for program synergy and sustainability at other institutions.
RISE – Poster Board #88

Low- and No-Cost Ancillary Training Programs that Leverage RISE/MARC Infrastructure and Training Culture to Broaden Access to Research

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Motivation: The UTSA RISE and MARC programs support a robust doctoral preparatory culture but include only 20 undergraduates. Barriers to inclusion include limited training positions; citizenship requirements; ineligibility of students in NSF S-STEM programs; and programmatic academic, major and career path requirements. Approach: To broaden access for students interested in a Ph.D. in biomedical sciences, we implemented three low- and no-cost Training Programs: RISE-2, MARC-2, and the Work Study Research Training Program (WSRTP). We used a common application and interview process. Between June 2018 and May 2019, these programs served 23 trainees who participated as volunteers, Work Study recipients, received University matching support stipends, or were funded by their mentors. Outcomes: Trainees from all programs and levels of funding formed a vibrant training cohort. Preliminary external and internal evaluations reveal great benefit from the NIGMS-sponsored professional training, mentoring, and association with like-minded student researchers. Student feedback included, “If not for the program I would be struggling to find my actual passion,” and “The UTSA Program opened the possibility to research and graduate school.” Four trainees subsequently entered MARC, RISE and the McNair Scholars. Three have been admitted into Ph.D. programs (UTSA, Texas A&M and University of Florida) and another into a Postbaccalaureate program at the NIH. Lessons Learned: Ancillary programs with minimal funding can be used to firmly integrate normally-excluded students into NIGMS-funded training infrastructure. The impacts noted for these trainees parallel those identified for RISE and MARC trainees in regards to career and professional development and degree pursuit. We will further investigate whether their engagement arises due to them having a program identity (i.e. RISE-2) and a formal admission process; prior “adoptees” into RISE had not persisted. Further, the expanded training community may benefit the RISE and MARC trainees.
RISE – Poster Board #90

Creating an Environment that Nurtures Peer and Faculty-Mentor Support

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Cal Poly Pomona (CPP) is a public university with about 40% URM students who traditionally have limited access to research experiences. Their families know little about STEM research and consequently, many URM students do not consider a STEM research career. Our RISE program was designed to help address this issue. The program includes summer activities at CPP and RO1 institutions and academic year activities at CPP. There are three levels: Invitation Undergraduates (UG) exploring their interest in doing research; 2) Intensive UG with a strong desire to pursue research; 3) Intensive Graduates (MS) committed to pursuing a research career. For family support, we have evening sessions with students’ families where present and past RISE students share their experiences. The first summer, students participate at CPP in independent research projects (IRP), molecular techniques workshops, and professional skills workshops including grant and manuscript writing, oral communication, time management, journal club, PhD applications, and scientific seminars. During academic years, students continue their IRP, attend professional skills workshops and present their research at scientific meetings. The second summer, students do research at RO1 institutions. With this multi-focus approach, students develop strong, supportive and long-lasting peer groups, and are comfortable discussing their successes and challenges with the RISE Director, Mentoring Co-Ordinator and Program Administrator. Using surveys, student and faculty focus groups, faculty and peer mentoring, and alumni feedback, we have modified the program to maximize student success in their coursework and research, and importantly, enhance their confidence in being able to transition into a PhD program. Between 2009-2019, 78% of MS and close to 40% of UG have entered PhD programs. Emphasizing writing, oral communication, time management, open discussions about confidence building and the imposter syndrome, welcoming families, and maintaining contact with one another during and after RISE, have been the most useful for student success.
RISE – Poster Board #93

The Programming, Success and Challenges of the NIGMS Research Initiative for Scientific Enhancement at the CUNY- Medgar Evers College.

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Medgar Evers College was established with a mission to provide high quality professional and career-oriented undergraduate degree programs in the context of a liberal education. It is predominantly a minority institution with over 82% of its 6,500 students are African American, 35% of them enroll in sciences of which 75% are female. The RISE Program from the NIGMS is the only program in the college that supports underrepresented minority students specifically for biomedical research careers. In collaboration with the School of Graduate Studies at SUNY Downstate Medical Center, the program is structured to provide mentored research experiences, and training on professional development, presentation and networking skills to 16 participating students per year. Since the onset of the program 42 students have participated or are still in one of the years of the program. To date, twenty-six students have graduated of which over 60% entered graduate and professional programs -a much higher rate in the same time frame compared to the pre-award period. The program realizes the selection of participants and matches them with experienced faculty mentors, skills trainings, intentional interventions, institutional support and the effectiveness of the program manager as critical programing elements for success. With strong leadership, institutional support, dedicated faculty mentors and our various programing activities the program has gained campus-wide visibility and it contributed to enhance research culture and scholarships at the School of Science. The program’s visibility among students is the most gratifying. Student successes demonstrate more effectively than any other method the power of mentoring to engage, support, and educate students. The transformative power of program is seen in our local experience: with increasing student engagement, we experienced greater faculty and organizational engagement. As lesson learned, certain changes in programing activities are planned during next funding cycle to bring better success in reaching programs aims.
RISE – Poster Board #95

Rochester Institute of Technology RISE Scientists-In-Training Program for Deaf and Hard of Hearing Undergraduates

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Rochester Institute of Technology

Motivation: Deaf/Hard-of-Hearing (D/HH) scientists are underrepresented in the biomedical, biobehavioral, and clinical-research workforce. To redress this disparity, NIH funded the Rochester Institute of Technology (RIT) RISE program in 2017 to prepare qualified D/HH undergraduates to enter PhD programs in these disciplines. RIT has the largest population of D/HH mainstreamed students of any university in the world. RIT RISE represents a university-wide endeavor involving six RIT colleges encompassing 16 degree programs. Approach: RIT RISE focuses on three need areas for D/HH students, identified through an institutional self-assessment: 1) Specialized curricular and co-curricular programming to increase their competencies in the scientific method, scientific writing, career awareness, self-efficacy, test-taking, and leadership; 2) Individualized academic counseling and intensive mentored research training in labs and other research environments to develop their research competencies in specific disciplines; and 3) Programs to enhance institutional resources and campus culture to support D/HH undergraduate “scientists-in-training”, including faculty cultural-competence training, research-environment communication-access assessment, and new courses to train sign-language interpreters to work in research environments. Outcomes: Early outcomes include: 1) Enrollment of four qualified undergraduate RIT-RISE Scholars, representing biochemistry, environmental-health science, biomedical sciences, and criminal-justice-related public-health science, 2) Development of several on-campus research-related courses and workshops, and scientific sign-language interpreting courses, plus online versions exportable to other training programs nationally, 3) Development of best-practices materials to share with other university training programs and research environments that include D/HH and other underrepresented students and scientists, and 4) Dissemination of RIT-RISE program activities and RIT-RISE Scholars’ novel research results at national conferences. Lessons Learned: RIT RISE is demonstrating that career-driven D/HH undergraduate science students can produce and nationally disseminate rigorous scientific results, garner coveted summer research fellowships at other prestigious universities, and achieve academic and research credentials that make them attractive candidates for first-class PhD programs in biomedical, biobehavioral, and clinical research.
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