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BUILD – Poster Board #1

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

Dora M. Raymaker[1], Mirah Scharer[1,2], Ashley Widmer[2], Dhale Larsen Posadas[2], and Rebecca Miller[1]

[1]Portland State University, [2]BUILD 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.

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NRMN – Poster Board #7

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

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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.

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IPERT – Poster Board #10

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

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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.

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IPERT – Poster Board #12

IMPACT Program: Building the Capacity of Biomedical Trainees to Explore and Enhance the Impact of Their Research

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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.

IPERT – Poster Board #14

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.

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IPERT – Poster Board #15

I-Trep Program: Fostering Entrepreneurship in Biomedical Research

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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.

IPERT – Poster Board #16

ToxMSDT: An Innovative Toxicology Research Education Pipeline Program Introducing Underrepresented Undergraduate Students to the Field of Toxicology

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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.

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T32 Predoctoral – Poster Board #19

Increasing Graduate Program Diversity and Enhancing the Student Experience

Kristin Cooper and Anjon Audhya[1]

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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 other better, and connect with students to find out their individual needs and aspirations so we can best serve their needs.

T32 Predoctoral – Poster Board #22

The Program in Enhanced Research Training at OHSU

Cheryl L. Maslen[1]

[1]Director, 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.

T32 Predoctoral – Poster Board #23

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.

T32 Predoctoral – Poster Board #25

Rigor and Transparency in Graduate Education: Collaboration with the Center for Open Science

Gordon W. Laurie[1-4] and Karen Hirschi1,[4]

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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.

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https://cos.io
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T32 Predoctoral – Poster Board #28

A Wellness Initiative to Improve Mental Health and Well-being Among Graduate Students

Matthew Welch[1], Iswar Hariharan[1], David Bilder[1] and Wendy Ingram[2]

[1]Department of Molecular and Cell Biology, University of California, Berkeley; [2]Bloomberg 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.

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T32 Predoctoral – Poster Board #29

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

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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; $p < 0.0001$), 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.

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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

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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 **M**odular and **P**roject-based un**IT**s (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

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T32 Predoctoral – Poster Board #31

A Novel Clinical Skills Program for MD/PhD Candidates

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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.

T32 Predoctoral – Poster Board #32

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.

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T32 Predoctoral – Poster Board #34

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.

T32 Predoctoral – Poster Board #35

A Continuing Clinical Education Course to Maintain Clinical Competencies and Foster New Clinical Knowledge During the Graduate School Years of MD/PhD Training

William Geisler, Sushma Boppana, Kristin Olson, Randy Seay, and Talene Yacoubian

Medical Scientist Training Program, University of Alabama at Birmingham

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.

T32 Supplement – Poster Board #37

Hypothesis, Design and Biostatistics

Andrea L. Meredith and Matthew C. Trudeau

Department of Physiology, University of Maryland School of Medicine Co-Directors, T32 Training Program in Integrative Membrane Biology, University of Maryland, Baltimore (UMB)

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-affliated 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.

T32 Supplement – Poster Board #43

Biomedical Career Development Forum for Pre-doctoral Students at Northwestern University

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[1]Interdisciplinary Biological Sciences Graduate Program and [2]Molecular Biophysics Training Program at Northwestern University

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.

T32 Supplement – Poster Board #45

Science Communication Credential (SCC) to Enhance PhD Student Communication Skills

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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.

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T32 Supplement – Poster Board #47

Development and Impact of a Practical Statistics Course Tailored to Graduate Biomedical Scientists

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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.

T32 Supplement – Poster Board #49

Leading and Managing Projects and People

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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.

T32 Supplement – Poster Board #52

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.

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T32 Supplement – Poster Board #55

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.

T32 Supplement – Poster Board #96

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 degylcosylated 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.

T32 Supplement – Poster Board #97

A New Hands-on Paradigm for Teaching Experimental and Analytical Methods in Biomedical Sciences

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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.

T32 Supplement – Poster Board #99

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.

IRACDA – Poster Board #56

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.

MARC U*STAR – Poster Board #59

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.

MARC U*STAR – Poster Board #61

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.

PREP – Poster Board #64

Seminar Speakers as a Resource for Helping Trainees Succeed in Their Efforts to Become Scientists

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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.

PREP – Poster Board #67

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 BS – Poster Board #71

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.

Bridges BS – Poster Board #73

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.

Bridges BS – Poster Board #74

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.

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Bridges PhD – Poster Board #75

Fresno State and UC Merced Bridges to the Doctorate Program

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California State University Fresno (Fresno State) is in the fifth year of the Bridges to Doctorate Program with the University of California Merced, the 10th comprehensive Ph.D. granting institution by the Regents of the University of California. Students entering Fresno State come from academic, socioeconomic, health, and domestic statuses that are disparate from most other parts of the state of California. As a major comprehensive university in the area, Fresno State is charged with the responsibility of combating the educational and professional hurdles faced by this unique cross-section of the population. Specific objectives of the program are: (1) recruit at least four Master's students each year with a demonstrated commitment to complete a doctoral program in biomedical/behavioral research; (2) successfully train them during the Master's program in one of the four focus areas represented by the pool of participating bridges faculty to ensure a smooth transition to a PhD program; (3) provide academic guidance during the semester at Fresno State, summer internships at UC Merced, and financial assistance for two years in the development of scientific and research skills to ensure academic and professional enhancement; and (4) develop and implement an evaluation plan that will assess each aspect of the program so that improvements can be made in creating a successful bridge. As we are in the fifth year of the program, ~75% of the students have joined a Ph.D., program upon completing their M.S. at Fresno State. We are at the crossroads to continue serving the next generation of students based on the success of the program while evaluating a strategy on how to refine and improve the program based on lessons learned in the last four years.

IMSD – Poster Board 78

Increasing PhD Programs Diversity: From Single Program Change to Institutional Transformation

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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.

ISMD – Poster Board #84

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.

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IMSD – Poster Board #85

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.

RISE – Poster Board #91

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.

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RISE – Poster Board #92

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.

RISE – Poster Board #94

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.