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IPERT – Poster Board #17

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

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The overarching program goals of the Interactive Mentoring to Enhance Research Skills (IMERS) workshops, supported by an IPERT R25 grant, (GM0125680) are (a) to empower faculty at minority-serving institutions (MSIs) in their efforts to develop and submit competitive biomedical research proposals through intensive grant-writing skills training; (b) to build research-related individual and institutional capacity through training on the mentorship of student researchers; and (c) to sustain workshop momentum by embedding multiple levels of individualized mentored proposal development support during and after each workshop. This program is a continuation of a long-running series of NIH-funded training events led by Dr. Donald Frazier for over twenty years. The IMERS program is comprised of two on-site grant-writing retreats held on the University of Kentucky (UK) campus and three off-site regional workshops each year. On-site workshops (~25 attendees/event) are designed for highly motivated investigators who have submitted proposals to NIH without success and those who are actively planning NIH submissions. On-site workshops include consultation with actively funded UK investigators and UK Proposal Development Office staff. Post-workshop interactions between participants and UK faculty/staff are facilitated via a community listserv. The off-site workshops are targeted to faculty who are actively engaged in writing/submitting grants as well as to faculty new to NIH with an active interest in biomedical research. Workshops sessions cover a range of evolving topics including: Using NIH resources for program and funding information, pre- and post-award budget issues, the proposal review process, writing a high-impact specific aims page, writing an effective research strategy, rigor and reproducibility, responsible conduct of research, what to include in the NIH biosketch, navigating the NIH resubmission process, and how to effectively mentor and train student researchers. Workshop effectiveness is evaluated from application materials, workshop surveys, and post-workshop follow-up questions and is being continuously refined to address investigator needs.

IPERT – Poster Board #18

Hands-On Training Module in Rigor and Reproducibility: Promoting Credible Science

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Researchers' recurrent struggles to compare and reproduce published research results prompted the primary federal funding agencies (e.g., National Institutes of Health [NIH], National Science Foundation, etc.), scientific journals, press and ethic integrity forums, among others, to discuss scientific experiments' rigor and reproducibility as key factors in credibility of research, and, therefore, as essential elements in teaching and training future scientists. NIH was one of the first agencies to develop a set of guidelines to assure scientific integrity through rigor and reproducibility. The guidelines focus on the rigor required in four areas: reviewing the strengths and weakness of prior research and in developing the scientific premise; developing a research design based on the scientific method to achieve "*robust and unbiased*" results; delineating and explaining relevant variables such as, for example, sex, age, etc. that could make a difference in the outcomes; and, authenticating and validating chemical and biological reagents.

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

Research partially supported by grants to ER-M from NIH (R25GM116706) and NSF (HRD-1137725).

T32 Predoctoral – Poster Board #21

Development of Curricular Activities in Rigor and Transparency to Enhance Reproducibility

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

T32 Predoctoral – Poster Board #26

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

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

T32 Supplement – Poster Board #38

A T32 Supplement to Drive Advanced Training in Biostatistics and Acquisition of Practical Skills in Using R for Biomedical Graduate Students

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

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

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T32 Supplement – Poster Board #39

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

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

T32 Supplement – Poster Board 42

Design and Implementation of a Course in Rigorous Experimental Design

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

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

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

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

T32 Supplement – Poster Board #46

Design and Dissemination of New Lab Safety Training and Awareness Modules

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

T32 Supplement – Poster Board #50

Online evidence-based course design to expand reach of rigor and reproducibility curriculum

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

References: Ioannidis JPA. Why most published research findings are false. PLOS Med. 2005 Aug;2(8):e124. doi: 10.1371/journal.pmed.0020124.

T32 Supplement – Poster Board #51

Training in Rigor and Reproducibility: An Integrative Approach

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The Graduate Program in Molecular Biology, Cell Biology & Biochemistry (MCBGP) at Brown University has recognized that training for predoctoral students in scientific rigor and reproducibility is essential for student success and the advancement of biomedical research. We have identified *four key questions* bearing on rigor, reproducibility, and transparency that graduate students will learn to address: *(1) What is the scientific premise of the proposed research? (2) Are the student's proposed experiments rigorously designed, with statistical analysis planned from the outset? (3) Have the relevant biological variables been considered? (4) Does the research include authentication and validation of key biological and/or chemical resources?* In 2016 we designed a set of modules for training in rigor and reproducibility (R&R), with development and implementation of these modules funded by NIGMS as a supplement to T32GM007601. After these modules were piloted by MCBGP first-year students in 2016-2017, feedback from both trainees and faculty indicated that some, but not all, modules were appropriate for early-stage trainees. Those modules: Experimental Design, Team Science, and Analysis of Published Methods and Data are now required for our trainees during years 1 and 2, and are offered to all predoctoral students in the Division of Biology & Medicine at Brown University. Our work to develop R&R training also revealed that many of these training activities are ineffective unless imbedded in a rich context such that training interfaces with the students' critical reading of the primary literature, and/or experimental design and research goals. R&R training activities have now been incorporated into our required coursework and training activities. Importantly, these activities begin during the first year, and continue throughout the training period.

T32 Supplement – Poster Board #53

Systems Pharmacology and Toxicology (SPaT) T32 Health Sciences Entrepreneurship Boot Camp

Philip R. Mayeux[1], Nancy J. Rusch[1], and Nancy M. Gray[1,2]

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The Health Sciences Entrepreneurship (HSE) Boot Camp is a residential training program initially funded by an NIGMS T32 training grant supplement T32GM106999-04S1 in 2016. The HSE Boot Camp has three primary goals: 1) enhance the breadth of career development activities to prepare students for the biomedical workforce; 2) support educational activities that complement traditional training by increasing awareness of entrepreneurial activity and the potential to commercialize ideas to improve health outcomes; and 3) reinforce the practice of team science as a mechanism for health science innovation. The Camp, currently funded through Arkansas INBRE, is an all-expenses-paid five-day training program in which students learn how to start and fund a startup, meet with potential investors, and become exposed to regulatory requirements, patents and legal issues. Student teams create and refine new venture ideas and interview potential customers. The first Camp was attended by fourteen graduate students in August 2016. Two participants from this cohort founded health science related startup companies within twelve months. A second Camp was conducted in May 2017. Twenty students from ten different campuses in the State of Arkansas attended it and two teams progressed to the 2018 Donald W. Reynolds Governor's Cup collegiate business plan competition. One team won first place in the innovation division and the second team won the $25,000 top prize. A third Camp was held in May 2018, with seventeen students from ten different schools. Recently, the Boot Camp earned a second place Innovations in Research and Research Education Award from the Association of American Medical Colleges. Diversity data are collected and compared to evaluate effectiveness in recruitment. Of the 51 total students to date, 53% were female, 25% were African-American, 10% were Hispanic and 8% were Asian. To date, we have enrolled students from 15 different colleges and universities across Arkansas.

T32 Supplement – Poster Board #100

Developing Training to Enhance Rigor and Reproducibility

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

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

Keywords: reproducibility, rigor, research ethics, ethics training

T32 Supplement – Poster Board #101

Knowing Your Audience: Essential Communication Skills for Diverse Scientific Careers

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Keywords: science communication; career development; supplementary graduate training

The goal of this T32 Administrative Supplement Award (GM066699-15S1) is to provide training in effective oral and written communication skills for Rockefeller University's graduate students, highlighting how these skills are leveraged in diverse careers for biomedical PhDs. To accomplish this objective, we have designed a new series of initiatives focused on the best approaches to effectively convey scientific concepts to a variety of audiences. In addition to providing specific strategies and practices for developing effective written and verbal communication skills, we also introduced students to non-academic career paths for which strong science communication is most essential, and provided opportunities to develop their knowledge base and network in these areas. In Part One of this series, we focused on engaging technical audiences, and offered modules on "Effective Writing by Scientists for Scientists", "Making the Most of Oral Presentations", and "Editorial Perspectives on Scientific Writing". We also highlighted "Careers in Scientific Publishing and Editing" through a 5-day mini-course. Part Two - "Making Science Accessible" – has included courses on "Exploring Science Journalism" and a "Teaching Story Telling Skills to Scientists" workshop, led by science journalists and science advocacy and policy professionals. Overall, the opportunities supported by this award have successfully enhanced the ways that we are developing the communication skills of our graduate students. This support has also expanded the view of how scientists can make significant contributions to the biomedical workforce beyond the research bench.

T32 Supplement – Poster Board #102

Workshop in Rigor and Transparency to Enhance Reproducibility for Bioinformatics Graduate Students

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

In the past few years, the failure of basic biomedical science to be reproduced in the best equipped laboratories was a truly stunning finding that needed to be addressed. As the world of

biomedical research has gone to fully digital data, how can we best ensure our students can keep up with best practices of handling digital data if we don't give them a strong foundation to build from? Our students training for a PhD in Bioinformatics on the Bioinformatics Training program (BITP), an interdisciplinary graduate training program in bioinformatics and computational biology, drawing >115 faculty from the Schools of Medicine, Engineering, Literature, Sciences and the Arts (including Departments of Mathematics, Statistics, Chemistry, and Physics), Public Health, Nursing, Pharmacy, and Information.

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

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

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

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

Funded by PA-18-756 supplement to the Bioinformatics Training program T32-GM-070449

MARC U*STAR – Poster Board #57

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

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

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

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

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

Both programs continue to be highly effective at providing underrepresented students with skills, resources, confidence, and overall enthusiasm necessary to pursue careers in research and sciences.

PREP – Poster Board #65

Sustaining Long-Term Collaborations Between a Tribal College and a Research Institution

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

PREP – Poster Board #66

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

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

Bridges BS – Poster Board #72

VCU Bridges to the Baccalaureate: Easing Transitions from Partner Community Colleges to a Large Urban R-1 Institution

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The VCU (Virginia Commonwealth University) Bridges to the Baccalaureate Program, with partners Thomas Nelson Community College (TNCC), and John Tyler Community College (JTCC), was initiated in 2013 and awarded a competitive renewal in 2018. This integrated student development, teaching, learning, and research training program addresses disparities in the preparation, persistence, and success of STEM transfer students from underrepresented (UR) groups, with the longer-term goals of increasing the number of UR STEM students who continue education at the graduate level and enter careers in the biomedical/behavioral sciences. Our program has facilitated transfer student preparation and persistence by: 1) enhancing advising, 2) developing two "hands-on" molecular biology courses, and 3) developing a quality summer research program for talented UR community college students. Partial salaries for the first FT STEM-H adviser at TNCC and the first FT Biology adviser/coach at VCU were partially funded; both positions were institutionalized in 2018. Joint STEM advising meetings have led to more integrated curricula, and defined course equivalencies and recommended course plans for prospective transfer students. Transfer agreements have been forged or improved. The two "hands-on" courses are directly-transferrable and economically sustainable; both were codeveloped by VCU, TNCC, and JTCC instructors and are taught at all three institutions. The VCU BTB Dream-to-Goal (DTG) Summer Research Program has trained 92 students. Of these, 30 have "bridged" to 4-year institutions, 28 have completed AS degrees, five have transferred to IMSD programs, 10 have completed BS degrees, two have matriculated to PREP programs, and one has matriculated to a PhD program. Finally, knowledge gained via this program provided the foundation for the recently funded VCU-HHMI Inclusive Excellence Program which focuses on larger administrative changes to facilitate the success of all VCCS transfer students at VCU.

Bridges PhD – Poster Board #76

EmpoweRU Student Coaching Program

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The EmpoweRU Student Coaching Program was born out of the recognition that students entering graduate school face daunting challenges that may jeopardize their future success and cause considerable stress and anxiety. Last year, we piloted a small program restricted to the multi-disciplinary graduate program on campus. We recruited six 2nd year graduate students, who excelled in their first year of graduate school and trained them as "Student Coaches." Coaching is the process of using deep listening and powerful questions to support coaches in finding solutions to their problems. Student coaches met with five to six 1st year students once a week the first month of graduate school and every three weeks afterwards. Topics addressed by the Student Coaches included: study strategies for different courses, setting up study groups, finding a rotation, and even how to write an email to a faculty member. Concurrently, we also offered EmpoweRU Workshops, run by Dr. Loren Runnels, which covered strategies for coping with stress and anxiety, goal-setting, and effective personal communication. The workshops offered another forum for students to get individual support on a range of issues. Overall the EmpoweRU Student Coaching Program was highly successful based on anonymous surveys. Students reported that they felt strong support from their student coaches. The program also helped them students to form social connections with other students as well as develop strategies for coping with their challenges. Students who needed help mitigating stress and anxiety because they were facing more severe academic challenges reported feeling substantial relief and support from interactions with their student coaches. We learned that students benefit from supportive relationships with student coaches and trusted faculty. Importantly, the EmpoweRU Student Coaching Program fosters a culture of support where students are empowered to stay on course to discover and realize their academic and professional potential.

IMSD – Poster Board #80

Addressing touch points within the academic pipeline: Ensuring student success through pipeline continuity

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

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

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

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

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

IMSD – Poster Board #86

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

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

RISE – Poster Board #88

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

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

RISE – Poster Board #90

Creating an Environment that Nurtures Peer and Faculty-Mentor Support

Authors: Jill Adler-Moore[1], Nancy Buckley[1], Airan Jansen[1], Angel Valdes[1] and Susan Tucker1

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

RISE – Poster Board #93

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

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

RISE – Poster Board #95

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

Vincent Samar, Paul Craig, Mark Rosica, Jason Listman, Kim Kurz, Stephanie Renner-Cosgrove, Kathryn Womack, Richard Doolittle

Rochester Institute of Technology

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