ABSTRACTS – POSTER SESSION A
BUILD POSTER A1

BUILDing SCHOLARS: Combining Asset Bundles with High Impact Practices

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NIGMS/NIH TWD Program: Diversity Program Consortium/BUILD

Keywords: BUILD; Boot Camp; Course-based Undergraduate Research Experiences; Summer Research Experiences

Abstract: In order to train the next generation of biomedical researchers and contribute to a diversified biomedical research workforce, the student development activities of our NIGMS-funded BUILDing SCHOLARS1 project are based on the premise that progress in recruiting and retaining the most talented minority students in the sciences requires institutional investment in five types of asset bundles: 1) educational endowments, 2) science socialization, 3) network development, 4) family expectations, and 5) material resources. This presentation will focus on just three of the multiple interventions associated with the first three bundles, which are addressed through a rigorous training sequence that engages our students in various dimensions of undergraduate research and other high impact practices. The summer prior to their first semester, incoming BUILD freshmen participate in a 3-week boot camp that prepares them to transition to the rigors of a university environment. Then, as entering freshmen students enroll in a 3-course research intensive sequence that is open to all students on campus. Through the duration of the program, BUILD fellows spend their summers conducting research with faculty at one of 12 research partner institutions or at UTEP. Results of post-boot camp subject tests show a significant increase in preparation relative to pre-boot camp tests. Data also demonstrate a sizable increase in freshman to sophomore year retention for all students who enroll in the research intensive course sequence relative to students who take the traditional courses. Additionally, answers to survey questions intended to gauge the impact of the summer research experience, such as those measuring development/increase of science identity and self-efficacy, and intent to pursue PhDs and biomedical research careers, resulted in over 78% agreement/strong agreement. This indicates that BUILDing SCHOLARS is on track to increase the overall percentage of UTEP students who will eventually join the biomedical research workforce. 5UL1GM118970-03

References
Project Pathways, BUILD Program at Xavier University of Louisiana

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Keywords: Biomedical Research; Student Training; Academic Support.

Xavier University of Louisiana is a historically Black and Catholic institution whose mission is to “promote a just and humane society” by educating students in a diverse learning environment. Even though Xavier’s reputation in the sciences attracts many of the best and brightest students, the University also continues to provide an excellent educational opportunity to many students who, due to socioeconomic disparities, lack the appropriate preparation for college, and thus are not welcomed by many other institutions of higher education.

The ultimate goal of Project Pathways, the BUILD Program at Xavier, is to increase the number of students who actively consider biomedical research careers and ultimately enter graduate programs in biomedical disciplines, successfully earn terminal degrees, and enter the biomedical research workforce. Xavier's plan to meet this challenge is based on a holistic approach, providing an integrated and coordinated student support and research skills training network. This coordinated effort cuts across academic departments in biomedical disciplines, academic support offices that include the Student Academic Success Office (SASO), the Office of Career Services (OCS), and the Center for Undergraduate Research and Graduate Opportunity (CURGO), as well as the Center for the Advancement of Teaching and Faculty Development (CAT+FD) for faculty support and mentor training. This work seeks to counter the regular practice at higher education institutions that have yet to address the importance of integrated programming across academic programs, student support programs, and research programs, lack of which often leads to duplication of efforts and ineffective use of resources. Xavier's BUILD program intentionally provides mechanisms and safeguards to ensure that coordination and integration occur at all levels.

Through Project Pathways, the students are provided with academic support, career information and counseling, research training, and opportunities for networking and developing their scientific communication skills. In addition, they receive hands-on mentoring by faculty and program staff. BUILD provides faculty with pedagogical and mentor training workshops as well as research funding through pilot grants. In addition, the Program provides post-baccalaureate research skills training in form of one-year BUILD Technician positions. Project Pathways is now in its third year. Early stage assessment results are very encouraging; however, full longitudinal assessment of the various program initiatives is required to determine final program outcomes. The Project Pathways’ initiatives can be replicated at institutions whose goal is to have a positive impact on the matriculation of individuals from underrepresented populations into and through biomedical doctoral programs and eventually into the biomedical workforce.

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BUILD POSTER A3

BUILD EXITO: Partnering for Undergraduate Research Training in Biomedical Fields

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Abstract:

As part of the NIH BUILD initiative to diversify the scientific workforce, the EXITO project is a large multi-institutional providing comprehensive support and training for undergraduates from traditionally underrepresented student populations who aspire to health-related research careers. Portland State University (PSU), a major public urban university, and Oregon Health & Science University, a research-intensive academic health center, lead the EXITO network of eleven 2-year and 4-year institutions of higher education spanning Oregon, Washington, Alaska, Hawaii, Guam, American Samoa, and the Northern Mariana Islands. The EXITO project is a multi-level intervention offering a three-year research training pathway for scholars across multiple disciplines in the biomedical, behavioral, health, and social sciences. Fundamental components of the model include student outreach and engagement, integrated curricular enhancements, intensive research experiences, three tiers of developmental mentoring, supportive community and services, and rigorous evaluation and quality improvement. EXITO features several innovative approaches to research training, including supported summer entry into research placements, incorporation of responsible conduct of research content into general education curriculum, and intentional matching of scholars with three types of mentors (e.g., peer, career, research). EXITO also addresses the sustainability of undergraduate research training by addressing faculty and institutional development that includes holding curriculum development conferences, creating research learning communities, awarding pilot project research funding, providing mentor training and ongoing support, collaborating with other research equity programs, and developing campus infrastructure and services to support scholars with diverse backgrounds and needs. The EXITO project involves inter-institutional coordination to accommodate students transferring from 2-year partner institutions to PSU, as well as inter-institutional replication to deliver the program model in its entirety at partnering 4-year institutions. Preliminary findings and insights are reported from evaluation of consortium-wide and site-specific outcomes reflecting student success, faculty development, and institutional development. 5RL5GM118963-03, 5UL1GM118964-03, 5TL4GM118965-03
Finding the Best Match: Managing a Multi-Institutional Mentoring Program using an Online Mentoring Interface

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NIGMS/NIH TWD Program: Diversity Program Consortium/BUILD

Key words: mentoring, undergraduate research, BUILD

Abstract: Our NIGMS-funded BUILDing SCHOLARS program involves 100+ undergraduate students from over 20 majors, faculty mentors from the primary institution, and faculty mentors from 12 research partner institutions. The need to effectively coordinate a faculty-mentored research program across the 13 institutions motivated us to experiment with an on-line mentoring software program from Chronus™. We customized the software for our program needs with help from Chronus™ technicians. Each user is invited to complete a profile form, which includes their basic information, CV, and research interests. Students are matched to faculty by program personnel, with the help of a matching algorithm. Once the pairs are matched, faculty nominate a ‘second mentor’ (e.g., graduate student), who is linked into the connection. The connected students and mentors then access a tailored connection plan, which is also distributed via email. They are prompted to schedule meetings, to complete a mentor-mentee compact and individual development plan, and to meet deadlines (e.g., turn in research poster). We use the profile forms to match students for summer research, but also for academic year research and with peer mentors in our peer mentoring program. On a survey of academic year mentoring program participants (n=~80), users rated the system as approximately a 5 on a 7-point scale, in terms of ease of use, satisfaction, and functionality. They rated the mentoring content received as a 4 on a 7-point scale. The best aspects of the system, as reported by users, were the reminders of due dates and the accessibility of mentor profiles, which can be easily browsed by students. The worst aspects related to user perceptions of excessive email volume and information overload. In terms of lessons learned, the system can be an effective tool for managing a dispersed mentoring program, even though users may express skepticism regarding its utility.

References:
http://chronus.com/
https://buildingscholars.chronus.com
An Entrepreneurial Training Model to Enhance Undergraduate Training in Biomedical Research

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The NIH Building Infrastructure Leading to Diversity (BUILD) Initiative was established to fund innovative undergraduate research training programs and support institutional and faculty development of the recipient university. The training model at Morgan State University (MSU), namely “A Student-Centered Entrepreneurship Development training model” (ASCEND), is one of the 10 NIH BUILD-funded programs, and offers a novel, experimental “entrepreneurial” training approach. In the ASCEND training model, the students take the lead. They own the research, understand the big picture, and experience the entire scope of the research process, which we hypothesize will lead to a greater sense of self-efficacy and research competency, as well as an enhanced sense of science identity. They are also immersed in environments with substantial peer support, where they can exchange research ideas and share experiences. This is important for underrepresented minority students who might have fewer role models and less peer support in conducting research.

We will describe the MSU ASCEND entrepreneurial training model’s components, rationale, and history, and how it may enhance undergraduate training in biomedical research. We also discuss evaluation methods, possible sustainability solutions, and programmatic challenges.

Morgan State’s ASCEND program is supported by the National Institute of General Medical Sciences, National Institutes of Health, under Award Numbers UL1GM118973, 8RL5GM118972, and 8TL4GM118974.
Engaging Rural Students in Biomedical Research Through One Health Focused Undergraduate Research Experiences

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Abstract: The large size of Alaska and resulting subsistence lifestyle is a challenge for traditional western-based approaches to student engagement. By presenting biomedicine in the context of the One Health Paradigm, which explicitly links animal, environmental and human health, we hypothesize to be able to specifically engage and retain underrepresented students into this program that synergistically integrates research and teaching and aligns more closely with indigenous patterns of learning and teaching. Our Biomedical Learning and Student Training program (BLaST) provides undergraduate research experience in a One Health context to train students in a meaningful way.

Initial quantitative and qualitative data from students and faculty indicate high levels of engagement and satisfaction with mentored research experiences. Undergraduate researchers report significantly increased interest, comfort, and competency in laboratory research, and improved understanding of science and of laboratory research methods (p<0.01 in all cases; Wilcoxon Paired Sample Tests). Trends suggest undergraduate researchers from rural backgrounds are especially interested in connections between animal/environmental health and human health.

Together our research suggest that the One Health concept which includes zoonotic diseases is a valuable tool to engage students in research and make this research more meaningful especially for students from a rural background that are underrepresented in biomedical research.
BUILD POSTER A7

Transitioning From an Emerging to Established Research Institution

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Keywords: Physical Infrastructure, Research Curriculum, Institutionalization

Abstract: The NIH’s Building Infrastructure Leading to Diversity (BUILD) program gave Long Beach State the opportunity to expand the scale of training programs, and to leverage institutional change supporting the transition from an “emerging” to an “established” research institution. This poster focuses on two key components of the effort: the campus physical and curricular infrastructure.

In partnership with the university, physical infrastructure investments include renovations of campus spaces, purchase of state-of-the-art major and mid-sized research equipment targeted to needs of the four colleges participating in BUILD. Hundreds of CSULB students and faculty have utilized these resources to advance the number of research projects and level of research on the campus.

More than a physical infrastructure, strengthening a research culture requires a motivated community of scholars. Keeping with the goals of enhancing the number and diversity of researchers and addressing institutional goals of enhancing completion rates and time to completion, we added a curricular solution in our Research Career Exploration course which brings aspects of freshmen advising and individual development plan creation with an emphasis on exploring the potential of research careers to serve the values and community focused interests of our students. The logistics of this have delayed the inauguration of the course until Spring 2018.

Once engaged by the prospect of a research career, students can now participate in the BUILD developed CSULB Research Curriculum, which provides research skills training through courses in Interdisciplinary Approaches to Health Disparities, Scientific Research Communication and Introductory and Advanced Research Methods. Providing General Education credit ensure we had minimal impact on time to degree and support introduction into degree plans. Course development and general education certification slowed offering courses, but all have been offered and enrollment pressure from two already supports optimism about institutionalization.

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NIGMS Workforce Diversity Programs at Xavier University of Louisiana

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Keywords: Biomedical Research; Student Training; Academic Support; Synergy.

Xavier University of Louisiana is a historically Black and Catholic university nationally recognized for its STEM curricula. Seventy-nine percent of current Xavier undergraduates are majoring in biomedically related disciplines. According to the US Department of Education, during the past decade, Xavier has ranked first nationally in the number of African American students earning undergraduate degrees in Biology, Chemistry, Physics, and the Physical Sciences overall. The University is also first nationally in the number of Black graduates who go on to earn doctorates in the Life Sciences and fifth in producing African American students who earn their PhDs in Science and Engineering. Despite these accomplishments, the average percentage of Xavier Biomedical graduates entering graduate programs directly after graduation is only 16%. On average, 41% of Xavier’s new freshmen annually enter a premed curriculum; however, only 4% of Xavier’s annual graduating class actually enter medical schools. Also, despite a significant proportion of students entering Xavier as Pre-pharmacy majors, only about 28% of these students are accepted into Pharmacy School. Xavier thus has a large number of Biomedical majors who with additional research exposure, support, and career counselling could potentially choose careers in Biomedical research.

Training, Workforce Development, and Diversity programs at Xavier (Building Infrastructure Leading to Diversity (BUILD), Maximizing Access to Research Careers (MARC), and Research Initiative for Scientific Enhancement (RISE)) work together to try to reach these students and increase the number of graduates who pursue careers in biomedical research. Through close collaboration the three programs are able to work synergistically to increase effectiveness, reduce duplication of efforts, and leverage all funding to promote programmatic goals. The programs coordinate with Xavier’s Center for Undergraduate Research and Graduate Opportunity (CURGO) in recruiting and selecting students for the programs. The mechanisms of this collaboration and the impacts on the programs will be presented.

Funding: NIH NIGMS award numbers 5UL1GM118967, RL5GM118966, 5TL4GM118968 (BUILD), 5T34GM07716 (MARC), and 5R25GM060926 (RISE)
“Do You Play Fair?” is an NIH-sponsored training (IPERT-GM114002) that explores and addresses biases that impede student success in STEMM fields. Fair Play is a video game designed to raise awareness about stereotypes, microaggressions, and other racial biases in academia (NIH-GM08352). In the game, players step into the shoes of Jamal, an African-American graduate student who experiences bias incidents as he navigates through his academic career and interacts with faculty, staff, and students on a college campus. Fair Play enables players to experience and learn about many forms of racial bias firsthand, providing an engaging and dynamic environment for perspective-taking and increasing bias literacy, which helps to reduce bias and afford Black students equal opportunities to excel in science (Kaatz et al., 2017). The training is modeled after other evidence-based bias literacy workshops (Carnes et al, 2015). The first module presents research on unintentional racial bias (i.e., “implicit bias”) and how it functions as a “habit of mind.” In module 2, participants play through Fair Play. Following game play (module 3), participants reflect on their experiences as Jamal and learn about a variety of evidence-based techniques that have been shown to yield long-term change in implicit bias. Besides conducting this training at national venues, the team is invited to different institutions of higher education. As this program begins its third year, training of workshop facilitators across this country is a priority for its dissemination.

Funding: NIH-GM08352, IPERT-GM114002
The American Society for Cell Biology (ASCB), the Minorities Affairs Committee (MAC) Research and Educational Career Development Program for Cell Biologists: An Integrated Approach was built on the success of our previous career-stage appropriate programming for junior scientists and postdoctoral fellows who are members of underrepresented groups and for faculty members at under-resourced colleges and universities. This project revolved around five activities developed and directed by the ASCB MAC:

- **Mentoring Academy**: This activity provided professional development workshop sessions for over 100 undergraduate and graduate students, postdoctoral fellows and junior faculty members at the Mentoring Symposium and Academy at the 2016 ASCB Annual Meeting.

- **Outreach Activities**: The ASCB MAC provided travel awards to 14 undergraduate students, 35 graduate students, 13 postdoctoral fellows, and 23 junior faculty members to attend and present at the 2016 ASCB Annual Meeting. In addition, MAC members coordinated sessions at ABRCMS and SACNAS meetings and disseminated information about MAC programming, other ASCB activities, and other professional development opportunities via email distribution lists and social media posts.

- **Visiting Professors Program (VP)**: Four faculty members from MSIs or PUIs were supported for mentored training experiences at research-intensive universities. These experiences should have significant impacts on their career trajectories and on the research capabilities at the VPs’ home institutions.

- **Junior Faculty and Postdoctoral Fellows Career Development Workshop**: The 2016 Workshop in Raleigh, NC was attended by 12 postdoctoral fellows, 11 junior faculty members, and 4 at others career stages. The 3-day workshop included 27 sessions on topics ranging from grantsmanship to networking to how to mentor students.

- **Linkage Fellows Program (LF)**: Seven faculty members at under-resourced campuses were supported to engage students in activities centered on Cell Biology. These context-relevant programs implemented by the LFs impacted hundreds of students.

- Supported by NIH NIGMS TWD 5R25GM116707 awarded to the ASCB
The Leadership Alliance Synergistic Network to Enhance Research that Grows Innovation (SYNERGI)

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Keywords: Undergraduate skill-building; Professional development; Mentoring; Career training

The Leadership Alliance is a national partnership among 36 institutions and private industry. The Alliance flagship programs include the Summer Research Early Identification Program (Ghee et al., 2016) and the Leadership Alliance National Symposium. To expand training and mentoring activities, a collaborative effort, SYNERGI, SYnergistic Network to Enhance Research that Grows Innovation, was formed among Brown University, Morehouse College, Spelman College, University of Chicago, and Vanderbilt University. The goal is to increase the readiness and competitiveness of underrepresented scholars as they train for and enter careers in the research workforce. Informed by the social cognitive career theory (Bandura, 1986), we propose that the provision of programmatic interventions at each stage of the academic pathway results in positive changes in trainees’ knowledge of careers, plans to pursue doctoral programs and research careers.

SYNERGI partners developed and implemented the Creating a Collaborative Learning Group and What is Research workshops for first year undergraduates. Post-workshop surveys revealed an increased understanding of the skills needed to effectively work within a collaborative learning group and the benefits of participating in undergraduate research opportunities. A career development workshop for graduate students and postdoctoral scholars incorporated the expertise of the NIH Broadening Experiences in Scientific Training consortium. Pre and post survey results revealed that participants demonstrated sizeable increases in their knowledge of research and non-research careers and acknowledged considerable gains on how to market themselves for research careers. A Faculty Retreat on Mentoring Diverse Scholars had an impact on participants’ heightened awareness of culturally sensitive issues in mentoring and emphasized the need for self-reflection and continued mentor training. Our results provide preliminary evidence of effective programmatic interventions that have the potential to increase trainees’ self-efficacy as they progress through the academic pathway.

The SYNERGI project is supported by an R25 IPERT award from the NIGMS.

References:

Leading Diverse and Emerging Scientists to Success (LEADS)

Authors: Doris Rubio, PhD, Lourdes E. Soto de Laurio, EdD, MPHE, Stephanie Bailey, MD, George Perry, PhD, Magda Shaheen, PhD, MPH, MS, Alex Quarshie, MD, MS, Todd Seto, MD, MS.

Motivation: To diversify the biomedical research workforce by training post doctoral scholars and junior faculty from six Minority Serving Institutions (MSIs) (University of Puerto Rico, University of Hawaii, Morehouse School of Medicine, Meharry College of Medicine, Charles Drew University, and University of Texas San Antonio) on practical research skills such as Critical and Creative Thinking, Grant Writing, and Team Science

Approach: In collaboration with our partners, we identified 9 areas where trainees lacked training. We created innovative online modules for each area using Moodle as the content management system. Scholars complete readings, videos, self assessments and participate in discussion board each week. In addition, we have weekly synchronous sessions for each module. All scholars are required to take the grant writing module and 8 other modules. After each module, trainees complete a brief survey to evaluate the module. The leaders at the MSI participated in an intensive face-to-face training session on how to be a career coach so that they can be career coaches for the LEADS Scholars at their home institutions. Travel awards are available to Scholars for them to attend a national conference to present their work or receive specialized training.

Results: In the first year, we selected 13 LEADS Scholars from 5 of the MSIs. Scholars value each of the modules and rated them very highly. One scholar already received a grant. Another scholar was accepted into NRMN Grant Writing Coaching Groups, and another scholar was accepted into the Early Career Reviewer program for NIH.

Discussion: Post doctoral scholars and junior faculty from MSI need practical research training to help launch their research career. We suspect that this is true of many institutions and plan to develop these modules so that they can be widely disseminated to other institutions.
NRMN POSTER A13

NRMN-CAN: Model of Multi-Institutional Cooperation in ESI Career Advancement

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Abstract

The absence of supportive mentoring practices may have a significant impact on the training environments and career trajectories of STEM trainees at all levels. These deficiencies are especially impactful on aspiring scientists from underrepresented (UR) populations who may be acutely sensitive to training environments that do not provide adequate mentored support, and in particular may lead to fewer UR postdocs entering the professoriate. Educators and scientists have recognized the need for enhanced professional skill development and grantsmanship training to address the lower success rates for postdocs and junior faculty in obtaining NIH funding. Unfortunately, with constricting institutional budgets and increased pressure on faculty time, it is often difficult for individual institutions to muster the resources and instructional talent to provide adequate training in all the areas needed to launch an academic career.

Through a National Research Mentoring Network (NRMN) Supplement, the Big Ten Academic Alliance (15 institutions) has 1) leveraged its individual institutional resources, 2) built multi-institutional cooperatives, 3) created inter-institutional mentoring and grantsmanship training teams, 4) and is continuing to track outcomes to measure the effect of evidence-based interventions on changing institutional culture to benefit the careers of postdocs and faculty.

This extensive program has provided professional development and grantwriting experiences to aspiring scientists, especially underrepresented populations, and assisted faculty and administrators in developing core competencies for mentoring and grantwriting. Our results indicate that these programmatic interventions have enhanced the career potential for diverse mentees, as well as improved the training climate and built capacity for sustaining and disseminating these activities at our partner institutions.
NRMN POSTER A14

Training Curricula For Improving Mentoring Relationships Through the National Research Mentoring Network (NRMN)

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Keywords: mentor; mentee; training; cultural diversity; curricula

NIGMS/NIH TWD Program: NRMN

Abstract:
Research indicates that mentoring relationships play a critical role in the retention and success of trainees across the career spectrum. Despite its importance, mentors and mentees do not often have the skills needed to optimize their relationships. The National Research Mentoring Network is working to provide all trainees across the health sciences with evidence-based mentorship and professional development programming that emphasizes the benefits and challenges of diversity, inclusivity, and culture within mentoring relationships, and more broadly the research workforce.

NRMN’s Mentor Training Core provides career-stage appropriate training for mentors and trainees with a focus on broadening and deepening impact of mentoring relationships on the persistence and success of diverse biomedical research trainees. This is achieved through implementation of in-person training at institutions and organizations across the nation, in addition to synchronous and asynchronous online training. Evaluation data are being collected from all training events, with a particular focus on the high dosage events and include: participation; satisfaction with elements of training; self-reported knowledge and skill gains from training; and intent to apply/actual application of knowledge and skills gained from training. The Mentor Training Core has developed training interventions for mentors and mentees that are evidence-based, culturally-tailored, innovative, and can be implemented in a variety of formats and venues.

This poster will provide an overview of training with particular focus on descriptions and preliminary data of new mentor training modules focused on: 1) cultural aware mentorship; 2) mentee research self-efficacy; 3) a library of >80 mentee training activities. Aligned with the mission of NIGMS/TWD, NRMN is committed to working with the broader community of trainers and educators dedicated to developing a well-prepared, diverse biomedical research workforce.

This work was supported through the National Research Mentoring Network (NRMN) funded by NIH/NIGMS Award Number U54GM119023.
Addressing STEM persistence by training undergraduates to communicate science, navigate scientific culture and build effective mentoring relationships

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Abstract: Career advancement for scientists from underrepresented (UR) groups can be impeded by the transmission of cultural norms and development of crucial skills occurring outside standardized classroom learning and instead relies upon informal relationships with colleagues and mentors. Learning how to communicate one’s research to a variety of audiences and understanding how to get the most out of mentoring relationships are examples of keys to STEM success that are rarely explicitly taught. Similarly, the impact of social factors such as Implicit Bias are often not openly addressed by institutions and leaders responsible for training STEM students and yet have disproportionate impact on engagement and success of UR trainees. We have created and institutionalized a semester-long course for STEM undergraduates engaged in research to strengthen scientific communication, demystify social aspects of the culture of science and strengthen mentoring relationships. The course utilizes a “flipped” model in which classroom time is used to reinforce skills and concepts encountered in readings and assigned work out of the classroom. Class meetings include work on scientific communication and exploring the culture of scientific research. Multiple methods were employed to evaluate student learning, including pre- and post-course surveys, regular student feedback, and graded performance in assigned tasks such as written work and oral presentations. These quantitative and qualitative data describe strong improvement in a range of student’s scientific communication skills and the ways in which mentoring and social factors contribute to success in STEM careers. Similarly, we found a shift in the topics students associate with the inhibition of communicating science to include curriculum topics, such as impostor syndrome and communication styles. As mastery of the range of concepts covered is both hard to gain and critical to persistence in scientific careers, the approach is a valuable addition to attempts towards increasing diversity of the STEM workforce.

Reference: https://nrmnet.net/collaborate/rfa/2015-pilot-4-of-7/
Development of Graduate Course “Science Communication in the Digital Age”

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Keywords: communicating science; diverse audience; digital media; equipping scientists; alternative careers

Abstract: To enhance the training of our graduate students in communicating research to diverse scientific and lay audiences, three NIGMS-funded training programs at the University of Iowa collaborated to develop a new course “Science Communication in the Digital Age” (RHET:7500). Development of this course was supported by an administrative supplement by NIGMS (PA-15-136) as well as matching internal funds. Directed by senior lecturer Matthew Gilchrist of the Department of Rhetoric, this 2-credit course is offered every spring semester and features guest lectures by faculty from several biomedical departments as well as the School of Journalism and Mass Communication. The course aims to develop direct and succinct communication skills in order to convey science to both lay and peer audiences, and to build skills in audio/video production, basic website design, and the suite of Adobe presentation software. The major goal is to make trainees more competitive in scientific careers both in and outside of academia. The course is part of the core curriculum of the Genetics (Eberl, PD) and Pharmacological Sciences (Strack, PD) training programs, and an elective for the Psychological and Brain Sciences (Lutgendorf, PD) program. A portion of the award was used to organize and support an annual, all-day graduate career fair/workshop, the first one of which was held April 23, 2016, entitled “Careers outside the Academy: Science Communication”. This poster showcases several student projects, presents comprehensive before-after skill surveys, as well as plans to enhance and expand “Science Communication in the Digital Age” in coming semesters. The authors are grateful for start-up support by NIGMS (T32 GM08629-19S1) and continued support of this course and career workshop by the Graduate College, the Department of Rhetoric, and the Office of the Vice President for Research and Economic Development at the University of Iowa.
Curricular Innovation toward Integration of Bioscience and 21st-Century Careers

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NIGMS/NIH TWD Program: T32 Supplements

Keywords: Careers; Curriculum; Ethics; IDP

Abstract:

Our project at Washington University in St. Louis integrates career exploration and planning into the second and third years of bioscience Ph.D. curriculum, encouraging students to consider career paths early in their graduate training. Students commonly avoid career development opportunities, or very lightly engage very late in their Ph.D. program. To jump-start career planning, we conducted two pilot courses that expose Ph.D. students in the Division of Biology and Biomedical Sciences (DBBS) to a broad range of science careers: Ethics, Bioscience, and Society, designed by Dr. Kurt Thoroughman; and Career Planning and Professionalism, designed and taught by Dr. Jessica Hutchins.

- DBBS students take a required course in responsible conduct of research in their second year; this required course considers laboratory bioscience within the academic research environment. The pilot section, Ethics, Bioscience, and Society, extends consideration to responsible conduct of research across the many workplace sectors engaging in bioscience: academia, industry, entrepreneurial ventures, nonprofits, and government. We recorded videos, in which student leaders in those areas interviewed most relevant national experts and scholars. These videos became source material for in-class discussion.

- Career Planning and Professionalism builds upon the initial exposure to broad research careers in Ethics, Bioscience, and Society. This course for third-year Ph.D. students formalizes the IDP process by facilitating self-assessments, career exploration, and goal-setting. Students worked in peer-led groups to conduct focused research projects on the career area of their choice, culminating in group presentations to the full class. Discussion topics included work-life balance, weighing interests and values in choosing a career, identifying transferable skills and filling skills gaps, conducting informational interviews, reading job ads, and searching for positions.

We will report on the successes of these pilots, in terms of faculty buy-in, institutional investment, integration into curriculum, and student outcomes.
Augmenting Ethics Training with Scientific Rigor and Reproducibility Concepts

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Keywords: reproducibility, rigor, research ethics, ethics training

All Berkeley MCF 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 expanded this 5 week required course to 10 weeks in the Spring of 2017. Students were first polled for the 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. In addition to these lectures, the students were required to attend weekly discussion sections for the first 5 weeks in groups of 10-15 trainees with MCF faculty who led case studies and shared personal experiences. We developed an instructor course website with training materials for faculty discussion leaders to use in their discussion sections. The materials included recommended case studies, as well as guides for the faculty discussion leader to present the particular case studies to the students. All materials consulted during curricula development were recorded on an OSF project site. 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 OSF project website, course website, instructor website, and digitized student evaluations are being made available to the curriculum advisory board, comprising faculty who are currently training grant PIs at UC Berkeley, for their evaluations and recommendations. Potential improvements already identified include expanding the new curricula in the areas of experimental design and statistical analysis, a broader use of multimedia training tools, and increased guidance for PIs who are new to the discussion sessions.

University of California Berkeley Chemistry-Biology Interface Training Grant Program
Project Number: 3T32GM066698-13S1
At UT Southwestern, we attract graduate students interested in biomedical sciences from across the United States and from many foreign countries. These students pursue scientific careers encompassing many disciplines and with a variety of goals. The challenge has been to provide career development that is of broad value no matter the considered career path. Therefore, our goal has been identifying and providing information that will be of significant benefit to all of our students in obtaining suitable positions in the scientific direction they have selected. We established a year-long program that covered two main professional development topics all scientists need – project management and communication (both in general and with a particular focus on science). This year-long development training program was comprised of didactic seminars including case studies, complemented by seminars presented by alumni and other professionals who shared career path stories and gave examples of how professional development skills manifest in day-to-day work in each of their current careers.

The Project Management program is described here. Project management is an important facet of professional development for graduate students in the biomedical sciences. While teaching these skills may often be implicit in doctoral training, our supplemental training course, Fundamentals of Project Management, allows graduate students the explicit opportunity to learn about and develop project management skills. Students concurrently learn how these skills are used in different biomedical careers – both in academia and ‘beyond the bench’. Training includes: 1. Interactive workshops with external speakers from a variety of biomedical professions who will discuss project management in their daily settings; 2. Self-assessment tools that will allow students to inventory their skills, with workshop sessions providing guidance on using the results to reflect on potential career paths and strengthening needed skills; 3. How to plan, manage, and present an individual project, in or out of the lab. Assessment of the program was conducted throughout the year via online survey tools, as well as unique measurements of the individual student. Students met individually with facilitators to discuss their project ideas and projected learning outcomes. Outcomes of the assessments were used to determine the program’s usefulness to the students, as well as to determine general student interest in this course as an elective part of the curriculum.
T32 Supplement at Stony Brook University: Enhancing Quantitative Training and Career Development Opportunities for T32 trainees.

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**Keywords:** quantitative skills; career development; electronic lab notebook; python; rigor and reproducibility

**Abstract**

The Training Program in Pharmacological Sciences requested a supplement in order to enhance the training received by trainees at Stony Brook University, focusing on Reproducibility and Rigor as well as Exposure of Students to Multiple Career Paths.

**Reproducibility and rigor.** The supplement catalyzed numerous modifications to our first-year curriculum: Stony Brook trainees in the Life Sciences now universally receive training in computational methods and statistics; seminars and faculty-directed sessions address issues of reproducibility; we have initiated a program to implement and encourage the use of electronic lab notebooks; hands-on modules have been introduced throughout the curriculum to teach trainees modern approaches to data processing and analysis.

Central to our effort was a program to provide trainees with ultraportable computing devices (Surface Pro). These enabled us to provide hands-on training in computational approaches, including a Python bootcamp, statistical analysis using R, image processing, a Structural Biology tutorial, big data analysis, plotting, compartmental analysis, etc. Furthermore, trainees were encouraged to use the devices to document their work during research rotations, leading to most of our trainees continuing to take advantage of electronic lab notebooks for their thesis work.

**Exposure to Career Paths.** The supplement funded the initial iteration of “Facilitating Awareness and Career Exploration for Scientists” (FACES). FACES is a trainee-organized event that brings together professionals with Stony Brook trainees to facilitate career exploration and networking. The initial FACES was extremely successful, took place again in 2017 and will become an annual event.

**Summary.** The T32 supplement resulted in the implementation of multiple new training elements, a new program to expand the use of electronic lab notebooks and a yearly career development event that is widely attended by trainees in the Life Sciences. The supplement has impacted several Graduate Programs and T32 programs at Stony Brook.
Rigor and Reproducibility Curriculum Development at Northwestern University

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NIGMS/NIH TWD Program

Keywords: Rigor; Reproducibility; Curriculum; Experiential

A supplement to the T32GM008061 training grant was used to develop two new graduate courses in scientific rigor and reproducibility (R&R) at Northwestern University. Both courses were launched in the Spring Quarter (March-June) of 2017. One course, \textit{IBiS 421}, is called \textit{Rigor and Reproducibility in Research}. Experimental design and data analysis is discussed through analysis of case studies on the topics of rigorous statistical analysis, transparency in reporting, data and material verification, and sharing. The course also establishes best practice guidelines for image based data and description of biological materials to uniquely identify the reagents (in particular antibodies, cell lines and animal models). Lectures include: Experimental design; Transparency in reporting; Data and material sharing; Statistical analysis; Description and authentication of materials; Image based data; Presentation of data. Students demonstrate knowledge and use of the techniques discussed by presenting experimental design and data analysis of their own doctoral research.

The other course, \textit{IBiS 416}, is called \textit{Practical Training in Chemical Biology Methods and Experimental Design}. It features two weeks of classroom and lab-based instruction on experimental design and analysis, supplemented by R&R training modules using case studies. Lectures and labs include: Data organization; Reproducible research; Github; Lab notebooks; Study design; Statistical analysis; Processing data; Plotting data; Data presentation. This is followed by a combination of lectures and labs addressing a broad range of analytical techniques. These lessons are then applied to inquiry based learning in six of Northwestern’s advanced instrumentation cores. For both courses, the curriculum and assessment tools were developed in consultation with NIGMS training program directors across Northwestern. Both courses were piloted with a small number of trainees this spring using team instruction approaches. Student reviews indicated that they found this training to be a valuable addition to traditional coursework.
Advanced Training in Business Entrepreneurship or Research Reproducibility: A Value Added Boot Camp

Approach

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Motivation: To expand and augment curricular activities associated with two NIGMS-sponsored training programs at Penn State University through a supplemental award (T32GM108563-02S1). Each training program addressed key components of PA-15-136; i.e. either promoting a strong foundation in research design and rigorous statistical and bioinformatic analyses (GM102057), or training to better prepare students for varied research careers in the biomedical sciences (GM108563). As such, we were positioned to build upon existing curricula to enhance and intensify each training program and widen the training audience at our institution. Approach: Streamlined training in the form of unique interdisciplinary 1-week executive style boot camps was used and specifically developed for graduate students and postdoctoral fellows across units in the biological and life sciences. For camp 1 (The Business of Science), we partnered with the Smeal College of Business and others to address key business, legal and regulatory aspects specific to the biotechnology enterprise, including Market Analysis, Finance and Valuation, Entrepreneurship, Business Plans, and Intellectual Property. For camp 2 (Biological Data: the Right Way), data reproducibility was addressed by faculty in Bioinformatics, Statistics and Biochemistry and Molecular Biology. As such, some content which was previously optional was now delivered through a compact, efficient and effective medium for both GM102057 and GM108563. Outcomes: A total of 60 students participated in 2016, and we anticipate an additional 60 students will participate in 2017. Lessons Learned: Students will register and not attend. We need to develop a mechanism which involves supervisor/mentor approval prior to registration confirmation. Sustainability and Dissemination: We will sustain our effort for at least four years through institutional matching commitments from the Colleges of Agricultural Sciences, Engineering, Health and Human Development, Medicine, and Science. We have used our website and press releases to disseminate results and impact.
We developed a new curriculum for NIGMS T32 students with the title “Hypothesis, Design and Biostatistics”. The goal of this course is to train students in principles of rigor and reproducibility, ethics, and decision-making in science. This curriculum was developed with NIGMS T32 Supplement funds to Dr. Trudeau. As laid out in the TPIMB T32 Supplement proposal, we combined elements from a course and a proseminar that covered hypothesis testing and experimental design and biostatics at Maryland. Faculty members worked with the new Academic Innovation and Distance Education (AIDE) Center on campus who helped design and develop student centered, engaging, learning experiences. Since the teaching materials are now recorded and on-line the course is sustainable. 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 at Maryland (including the MSTP). The course can be extended to other T32 programs at Maryland and our system campuses and to other NIGMS T32 programs at other sites. We have already trained 25 students in this course, and the course is now very popular and is in high demand. The course is best described as a hybrid course with a modular structure. It features recorded videos and on-line problem sets and quizzes for the students to complete prior to class or outside of class. In-class time is spent in small groups reviewing problems and problem sets with the guidance of the instructor. Each module is self-contained and features a similar format so that the students gain familiarity with the teaching style and course expectations. The goal is for principles from the course to inform the trainees’ laboratory research and enhance rigor and reproducibility.
Career Development for Biomedical Graduate Studies: Making It Count

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The mission of NIGMS-sponsored training programs is to provide discipline-specific educational and research opportunities that help us to foster the next generation of scientific leaders. In the past, this mission squarely targeted academic research positions as the ultimate career goal of our trainees. Recently, however, career goals have become increasingly diverse, as changes in federal funding levels for basic research, the availability of academic research, and the growth of biotechnology-related industries, among other factors, have dramatically altered the landscape of scientific careers. Currently a majority of graduate students report an interest in pursuing careers outside of academic research and some feel 1) they are not adequately informed of all the career options available to PhD students in biomedical sciences and 2) the training received is not sufficient to prepare them for such a career choice. With supplemental funding to our NIGMS T32 we developed two distinct resources to inform students about career opportunities: a “Learn to Lead” seminar series and a Career Development Website.

The “Learn to Lead” seminar series brought individuals from various careers in science to the University of Pennsylvania for a lunchtime seminar where students heard about the trajectory of the individual from completing his or her PhD to their current position, and provided ample time for Q and A. One or both of the following criteria were considered when selecting the speakers: (1) they received their PhD in the last 5-10 years and (2) they were Penn Alumni. Meeting speakers who received their PhD in the recent past allows our students to see the trajectory of PhD students that completed their training under similar training conditions, and allows them to imagine a trajectory that has relevance to them in the current work climate.

The Career Development web site organized and improved the visibility of existing and novel career-development resources at Penn. An overarching objective for the development of the site as to convey to students that competencies developed through pre-doctoral training in the biomedical sciences are valued in a variety of professions. Students often feel that they are not prepared for “other careers” outside academia, but in fact competencies in, for example, critical thinking, mathematical and computational practices, or management and communication are invaluable to any career. We specifically wanted to remind our students that all these skills are intrinsic to their training in a PhD program at Penn, hence the rationale for the byline of the site “Making It Count!” In addition the website navigates students through Career Paths, which provides descriptions of types of careers for which PhD training is attractive. It also hosts videos from individuals in each of the career paths, some of which participated in the Learn to Lead seminars. There is also a Career Blog, which provides a schedule of current seminars workshops and other events relevant to career exploration and development that occur on Penn’s campus. Lastly, an Alumni Outcomes is provided as an additional source of identifying specific career paths as well as a networking source.

The career development seminar series and website align with the goals of NIH and NIGMS training by enhancing the impact of our training programs to deliver well trained scientists to the workforce at large. The influence of having more visible career options available to our PhD students will be measured in outcome tables collected over the next 15 years.

Key Words: Career, competencies, graduate education
New Course: Skill Development for Diverse Scientific Careers B&BS 550b

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Keywords: biotechnology, entrepreneurship, resume writing, research residency, post-doctoral fellowship, productivity

The 2012 Biomedical Workforce Report concluded that our traditional graduate school training programs in the biological sciences do little to prepare our students for the wide variety of scientific and biomedical career options open to them. As one remedy, we have offered a new semester-long course that has addressed topics that are not currently covered in any curriculum at Yale: biotechnology entrepreneurship; how to run clinical trials; the business and scientific sides of biotech; strategies for optimal professional productivity; how to convert a CV into a resume; and how to find a post-doctoral fellowship or research residency. Speakers were chosen from our own successful graduates, when possible, to expose our current students to role models as well. The course was given an official course number through the BBS so that students with an 80% attendance record would receive credit on their transcripts. The Qualtrics survey done after each session confirmed that the course has served as a valuable new resource for all of our students as they transition into the biomedical workforce. Next year we plan to add a session on careers in publishing and science writing based on student feedback.

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Post-Baccalaureate Technician Program (PTP) at Xavier University of Louisiana

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Keywords: Biomedical Research; Post-baccalaureate Training; Research Skills.

Xavier University of Louisiana is the only historically Black, Catholic institution of higher education in the United States. The University is nationally recognized for its Science, Technology, Engineering and Mathematics (STEM) curricula. 79% of Xavier undergraduates are majoring in Biomedical disciplines. While Hispanics, African-Americans and Native Americans make up more than 30% of the US population, they earn fewer than 9% of all STEM PhDs. Bridge and post-baccalaureate programs have been viewed as effective interventions to dissuade attrition from the biomedical research workforce pipeline. The program described here is an initiative funded under the Research Enrichment Core of Project Pathways, the Building Infrastructure Leading to Diversity (BUILD) Program at Xavier. The BUILD Post-baccalaureate Technician Program (PTP) was modeled after a previously informal practice at Xavier in which recent Xavier graduates with great potential for graduate studies who lack full preparedness and/or competitiveness are offered one-year, full-time research staff positions. The Program provides these graduates with research training and opportunities for networking and developing their scientific communication skills. In addition to being mentored by faculty and program staff, Technicians also receive mentor training and act as mentors to undergraduate research students. The seven technicians in the first cohort completed their one-year training in summer 2016 and all have entered into graduate programs. The nine cohort two technicians are now completing their training and graduate school application process. The selection process for cohort 3 technicians is in progress. PTP, which provides Xavier graduates with post-baccalaureate research training at Xavier, has been very successful in its early stages. This program can be replicated at other institutions whose goal is to have a positive impact on the matriculation of individuals from underrepresented populations into and through biomedical doctoral programs and eventually into the biomedical workforce.

Funding: NIH NIGMS grants number RL5GM118966
Developing a Science Identity: Using Developmental and Critical Race Theoretical Lenses in an Undergraduate Research Training Program

Gabriela Chavira, Carrie Saetermoe, Crist Khachikian

While current efforts in diversifying NIH-funded research have been successful in developing opportunities for a wide variety of scholars from traditionally underserved communities, including people with disabilities and people from disadvantaged backgrounds, there remains a cultural lag in socialization to graduate programs, faculty positions, and NIH-funded research programs (Ginther et al., 2011). Specifically, African Americans and Latinos earned 6.0% and 6.8%, respectively, of all the doctorates in science fields, which is significantly less than their 50% representation in the general US population (NSF, 2015), and a similar pattern is seen for science and health doctorate holders employed by US universities and 4-year colleges.

BUILD PODER at CSU Northridge is part of the NIH-Diversity Program Consortium. Poder means “power” and “to be able to” in Spanish. BUILD PODER aims to build a biomedical workforce that thinks creatively and holistically about health disparities issues. To draw in and motivate student scholars, we employ developmental and Critical Race Theory (CRT) approaches to identifying and resolving social problems such as health disparities.

Two components of the student training were examined - the Summer JumpStart program, a four-week intensive entering to research experience and the year-long faculty mentored research. First, students’ research skills, self-efficacy, and research ethics knowledge significantly increased in four weeks. Qualitative analyses of students’ self-reflection essays describe themes focused on excitement beginning research, worries of not succeeding, and increased confidence. For example, one male student said, “I learned that I have the capacity to learn how to do research. I am more capable than I believed myself to be.” Second, qualitative analyses of students’ mentored research experiences highlight increased confidence and growth in their science identities. One female student wrote, “I now identify myself as a smart woman who’s a scholar and a researcher at CSUN.”

Our findings illuminate the importance of developing a science identity in undergraduate students’ interest, entry and retention in biomedical science majors.
BUILD POSTER A28

BUILD Group Research (BGR): Development and Assessment of a Six-Week, Authentic, Group Research Experience for Community College Students at a Research Intensive University

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Promising undergraduates, especially pre-transfer community college students, often have difficulty obtaining authentic research experiences, putting them at risk of not persisting in the science, technology, engineering, and mathematics (STEM) fields. To increase their preparedness and competitiveness, we developed the BUILD a Bridge to STEM Internship, a six-week summer internship for pre-transfer community college students that is supported by the NIH-funded STEM BUILD at UMBC Initiative. The internship involves students from five community colleges (Anne Arundel Community College, Community College of Baltimore County, Howard Community College, Montgomery College, and Prince George’s Community College) and Gallaudet University. A unique aspect of the internship is the BUILD Group Research (BGR) experience, where students work in teams of three to four members on authentic research experiences mentored by UMBC faculty or industry researchers. Participants in the BUILD a Bridge to STEM Internship are nominated by institutional representatives, are financially compensated, and participate in various enrichment activities in addition to working on biomedically-focused research projects. To date, two cohorts of students have participated in the study: 13 students in the summer of 2015 and 15 students in the summer of 2016. An evaluation of the internship has revealed that participants achieve significant gains in their science identity and research self-efficacy. Further, students report that this internship helps to clarify their career paths and inspires some students to continue in research careers. Further, this internship has provided UMBC an opportunity to pilot and refine the BUILD Group Research (BGR) model and explore other strategies to expand the benefits and capacity of authentic research experiences to more students with an interest in STEM disciplines through the creation of a short-term group research program.
Curriculum Development to Improve Training in Rigor and Reproducibility in the Albert Einstein College of Medicine Graduate Program

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Concerns about the rigor and reproducibility of biomedical research have arisen in the past decade. Causes include contaminated cell lines, mouse strain and source/housing on phenotype, antibody specificity, fundamental issues of experimental design, and invalid data analytic methods. While the first three are more technical, the fourth and fifth are problems in the graduate training process. Students must learn about experimental design and essential statistical principles, along with their implications for scientific rigor, before starting thesis research. This will ensure dissemination of best practices to their thesis laboratories. To achieve this goal at Einstein, existing courses and workshops were modified to emphasize experimental design (blinding, power, replicates, measurement error, variability); avoid pitfalls in data analysis (p-value hacking; multiple testing; missing data); transparent programming (debugging; clearly commented code); and proper reporting of results. To demonstrate the importance of these issues, four half-day sessions were added to the incoming PhD student boot camp. These introduce essential statistical concepts, quantitative and computational skills using the R programming language, principles of study design, best laboratory practices, and accounting for sources of biological variability and measurement error in an experiment. Students now must take the course “Quantitative Skills for the Biomedical Researcher” revised to cover current reproducibility issues and statistical theory for research reproducibility. Finally, we are launching our inaugural hackathon “Can We Hack the Fountain of Youth?” this July which will promote skills in reproducibility research as student teams compete to solve innovative questions centered on the science of aging by analyzing big datasets. By incorporating these activities into required courses, we ensure that all trainees are exposed to these important concepts. It is difficult to assess whether this will improve the quality of their scientific research, but one thing is certain, ignorance will not be an excuse for poor quality work.