Comparisons and Approaches of PREP Programs at Different Stages of Maturity: Challenges, Best Practices and Benefits

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The Postbaccalaureate Research Education Programs (PREP) are designed to provide research training and educational opportunities for recent baccalaureate graduates from targeted groups defined by NIH who would benefit by academic enhancements between the completion of undergraduate studies and admission to a PhD program. These programs offer exposure to the biomedical science community in a way that helps post-undergraduate individuals visualize future careers as well-trained, enthusiastic leaders in biomedical research who represent and will promote diversity in science. Specifically, PREPs provide the preparation and skills required for entrance into, and successful completion of, a PhD program via in-depth exposure to a research setting, which helps to refine the post-undergraduate's research interests, assists in providing a realistic understanding of the end results one can expect from research, and offers a forum for discussion with lab peers and mentors about possible career paths. Beyond the lab, PREPs offer programmatic activities to develop analytical, writing, and oral presentation skills necessary for a competitive graduate school application and success in graduate school thereafter. Individual mentoring increases the post-undergraduate's confidence and familiarity with members of the research community, so that pursuit of a PhD becomes a realistic and less-intimidating path. Interventions and developmental activities are matched to the background preparation, research experience, and learning style of each post-undergraduate. As with all training programs, there is no perfect model and each program must fit in and adapt to their respective institutional environments and cultures. Thus, in this article, we provide perspectives and approaches developed by a long-standing program in existence almost since the beginning of the PREP program along with one PREP at an early stage of maturity, having just been through one renewal. *Ethn Dis*. 2020;30(1):55-64; doi:10.18865/ed.30.1.55

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Introduction

It has long been recognized that diversifying the biomedical workforce is essential for advancing the research enterprise. However, despite decades of investment in diversity-directed initiatives only modest changes in career advancement of underrepresented (UR) individuals have occurred, especially in academics.[1] There are still significant dropout rates for UR STEM students along the educational pipeline; only 16% of UR students who enter college planning to major in STEM actually obtain their BS degrees. Of these STEM BS graduates, <10% are awarded doctoral degrees,[2] indicating that critical decisions and changes in majors occur during the undergraduate years and then during the transition between college and graduate school. These decisions are influenced by many factors including academic performance, perception of acceptance, self-identity, confidence, as well as peer and family pressure. Recently, attempts have been made to investigate which interventions and strategies focused on enhancing, sustaining, and translating UR trainees' interests and abilities, lead to active and sustained career pursuit in STEM.[3-5]

In 2000, the National Institute of General Medical Sciences (NIGMS) initiated the Postbaccalaureate Research Education Program (PREP),[6] a unique program designed "to enhance the diversity of the biomedical research workforce by supporting institutional programs that provide scholars with a one year scientific apprenticeship as well as academic and

professional development activities." As stipulated by NIGMS, the specific objective of PREP is to prepare individuals to successfully enter and complete rigorous PhD training programs. The institutional PREP programs that have been funded since initiation of the PREP have multiple features in common, although each may differ in the nature of the scholars recruited to the program (geographic differences, varied levels of academic preparation, prior research experiences), courses offered (PREP-specific courses vs standard graduate courses), level and variety of PREP-specific skill-building activities and whether they are intended (or not) as pipeline programs for their own graduate programs. The general framework of the PREP year is shown in Figure 1.

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Importantly, PREP scholars are essentially graduate-students-in-training. They receive a salary and concomitant benefits (funded by the R25 grant) and conduct research in a laboratory, mentored by the head of the laboratory as well as current graduate students or postdoctoral fellows. They may take one or more graduate courses, selected with the guidance of the lab mentor and PREP leadership, to fill gaps in their knowledge background, demonstrate ability to deal with challenging graduate course material, and expand the scientific readiness of the scholar for graduate study. In some programs, a beginning course for all PREP scholars introduces basic laboratory techniques and preparation for working in the lab (see "Lessons Learned" later in this article). In addition, throughout the PREP year, multiple activities help to: enhance the scholar's identity as a future graduate student and scientist; facilitate interaction and build a supportive network with peer PREP scholars and current graduate students; and enhance professional skills, such as writing and oral presentation. All programs also provide guidance and support throughout the complicated PhD application process, from help with the identification of programs of interest, to the preparation of the research statements, to interview preparation, and finally to decision-making about the graduate program that best fits their interests and needs.

In this article, we describe the experiences of PREP programs at two different institutions and compare these to a summary of national PREP outcomes.[6] In 2004, a PREP program was launched at the University of Chicago (UChicago) to create a pathway for UR postbaccalaureate students who are interested in academic careers and have an expressed passion for research, but who have deficiencies that preclude immediate acceptance to a high-quality graduate program or have experienced motivational barriers to proceeding in higher education. Somewhat later, in 2013, a PREP program was initiated at the Albert Einstein College of Medicine (Einstein) to provide an intensive mentored research experience, academic enrichment and skills development as well as application coaching to prepare UR individuals to enter PhD programs in the biomedical and behavioral sciences. In both programs, one long-standing and the other more recent, we have found that efforts concentrated on helping recent baccalaureate UR students understand how they learn, what motivates them, how to set goals (self-efficacy), and reinforcing that they belong and fit into the scientific community (cultural capital) during a post-baccalaureate year can be transformational, for both the individual scholar and for the institution. Please note: Throughout this article UR is used to include gender, racial, ethnic, disabled, and disadvantaged individuals, all of whom are underrepresented in the scientific workforce, especially in academic careers.

The social cognitive framework of PREP focuses on three pillars: 1) the academic preparation and professional skills required for entrance into, and successful completion of advanced training; 2) interventions to sustain and translate scholars' interests and abilities into meaningful career pursuits; and 3) social and mentoring activities that strengthen scholars' identities and self-efficacy as biomedical research scientists. Thus, PREP is designed to not only instill in the scholars the belief that they belong in science, but to broaden the perceptions, awareness

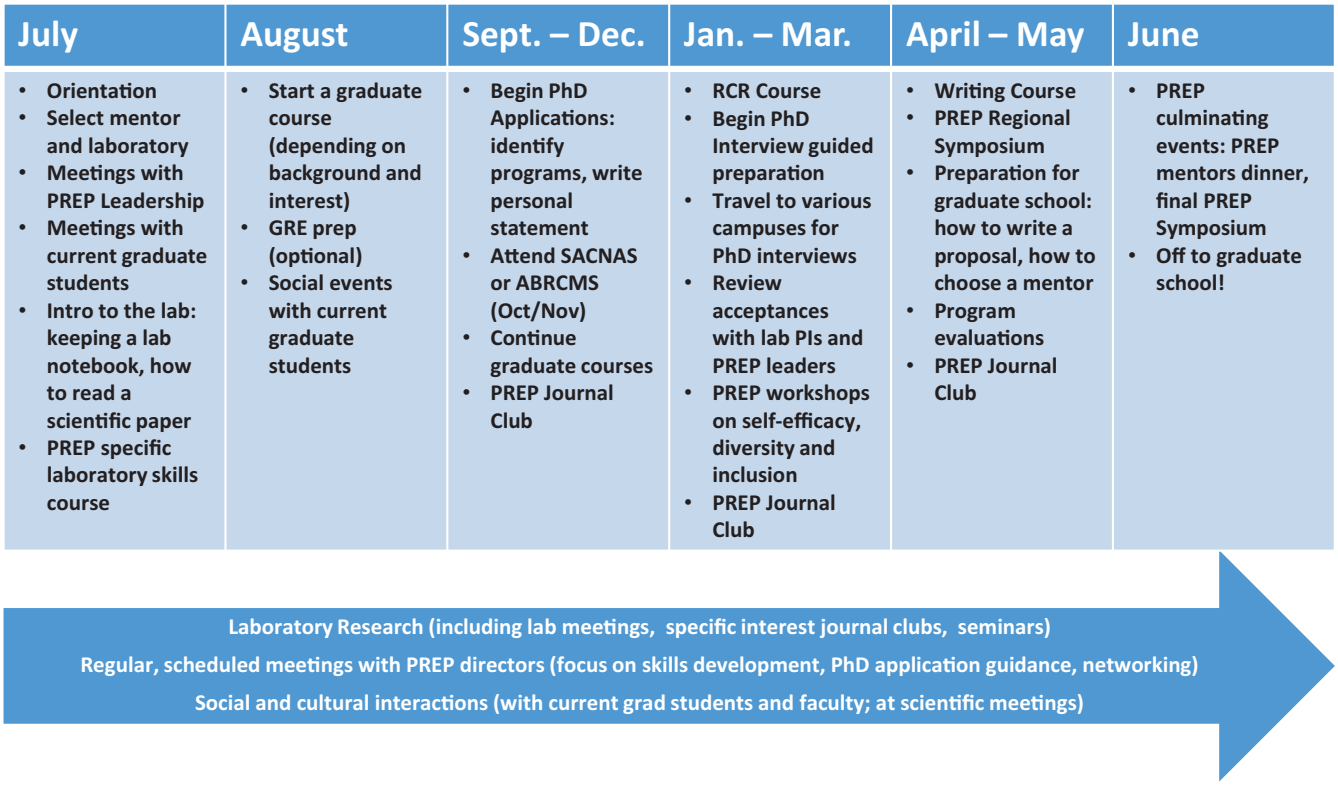

Figure 1. Postbaccalaureate Research Education Program (PREP) - 1 year plan

and acceptance of their inclusion by the entire academic community.

The conceptual framework, ie, the social and environmental context in which PREP scholars learn and develop, is critical when designing effective educational programs. Each PREP program is designed to meet the individual needs of each scholar by offering specific academic, skill-building, and cultural and social activities throughout the year. For instance, it is essential for PREP program directors to meet individually with the scholars to assess the backgrounds and needs of each scholar and then to design the PREP program accordingly. Certain activities are unique to each scholar (eg, specific graduate coursework, research projects, and lab-related meetings, journal clubs, seminars, etc.) and are designed to address deficiencies, enhance the scholar's preparation for graduate school, or deal with unique goals like changing research fields. Other activities are designed to benefit all scholars collectively in order to develop skills necessary for success in graduate school. Importantly, these group activities provide a sense of community, since the PREP scholars share a unique situation in having multiple sets of expectations as employees as well as graduate-students-in-training. Some activities are completed in one academic period (10–12 weeks), and others continue throughout the academic year, such as laboratory research that accounts for 75% of their time (Figure 1). The activities are grouped to fulfill three overarching goals: strengthen identity and self-efficacy as biomedical scientists; foster academic success and self-sufficiency; and enhance cultural competency and sense of belonging.

Methods

Core objectives as outlined by NIH guidelines are described for the two representative PREP programs as follows:

1. Recruit a pool of candidates and admit a highly qualified cohort of scholars with potential to enroll in graduate school.

Annual evaluation of the applicant pool outcomes includes not only numbers of applications to the PREP but also quality and characteristics (academic record and letters of recommendation), diversity (drawn from a variety of undergraduate institutions, multiple regions of the country, etc.), and need for the PREP training (nature of deficiencies). This information allows PREP program directors to adjust recruitment efforts in the next year to balance the applicant pool.

2. Assist each candidate in his/her choice of lab experience and mentor and monitor progress throughout the year in order to foster continued scientific growth.

Scholar progress and outcomes are assessed by the PREP directors from the mentors' evaluations, scholars' feedback, staff monitoring, and outside program review. This continuous process of individual scholar and program evaluation seeks to ensure that scholars demonstrate increased scientific self-efficacy, research confidence, sense of belonging in science, and intention to pursue graduate education and future science careers, by the end of one year in PREP, as indicated by enrollment in PhD programs.

3. Assist scholars in developing qualifications to be a competitive graduate school applicant (Tables 1 and 2).

Outcome metrics from the UChicago PREP (over the last 5 years) demonstrate that acceptance and matriculation of our PREP scholars into higher education programs averaged 91% into PhD programs, and 3% into professional programs (MD). Similarly, in the Einstein PREP (over 6 years), 95% have entered higher education programs (86% into PhD programs and 9% into MD-PhD programs) (Table 2).

4. Assist scholars in developing lifelong scientific concepts, research, and academic skills.

These attributes are essential to the development of a scientist. The success of instilling these are demonstrated by completion of an advanced program. 97% of UChicago scholars completed the PREP since 2004. Of those scholars from the UChicago PREP who matriculated into graduate programs over the past 15 years (94%) thus far, 35% received PhDs, 5% received MDs, and 11% received other advanced degrees (PharmD, MPH or MS), while 45% are still in training for a PhD, indicating that these educational activities instill the skills and resilience to persevere and succeed in graduate school. PREP scholars from the Einstein PREP are all still in training.

5. Provide a supportive mentoring environment that increases the scholars' networking base, familiarity with the culture of science, and identity as researchers.

It is critical that scholars become more aware of science as a social process, more capable of advocating for themselves, more confident in scientific activities and interactions, and more successful in charting a course toward their career goals as the program progresses, assessed by scholar and mentor evaluations and scholar exit interviews. We have found that attendance at scientific meetings (eg, Society for Neuroscience, American Society for Microbiology, etc.), as well as attendance and participation in scientific meetings specifically for UR students (eg, ABRCMS [Annual Biomedical Research Conference for Minority Students], SACNAS [Society for Advancement of Chicanos/Hispanics and Native Americans in Science]), enhances identity as a scientist as well as promotes self-confidence in presenting posters and speaking about scientific research.

Results

Data on characteristics of applicant pools for the most recent period of the UChicago PREP and the inaugural period of the Einstein PREP (2014-19) are presented in Table 1. During this period, the UChicago PREP received 801 applications, resulting in 40 matriculants to the program and Einstein received 820 applications for 29 matriculants. PREP applicants are recruited from across the country including Puerto Rico; at both UChicago and Einstein, most PREP matriculants are from minority-serving institutions (MSI).

Applicants are evaluated based on their need for an additional year of preparation for graduate school and their potential for success in biomedical science. The average GPA of the matriculants to the UChicago PREP is comparable to that of the entire applicant pool, ie, students with higher GPA are not given preference. Neither PREP utilizes a specific cut-off GPA (lowest admitted student at the UChicago had 2.15 GPA) and we will generally admit scholars who have some deficits in their transcripts.

However, we are cognizant of the reality that it is difficult to ameliorate consistent deficits in science course grades within the short one-year time frame of the PREP. Most commonly, we observe lower grades in the early years of PREP applicants' undergraduate education followed by an upward trend in GPA over time, indicating an ability to adapt to rigorous college-level courses. We also recognize that our applicants have sometimes faced challenges during their college years (eg, working to support themselves through college, health issues or other life-disruptive events). Overcoming obstacles during their education, and evidence (in the personal statements and letters of recommendation) that the applicant has met significant personal challenges while continuing to pursue a degree in science, and even attempting to perform some research, are indicators of "grit," an essential quality for success in science.[7,8]

On average, the UChicago PREP and the Einstein PREP matriculants had somewhat more research experience than the average applicant pool, usually demonstrated by participation in a Maximizing Access to Research Careers (MARC), Minority Biomedical Research Support (MBRS), or Summer Research Program during college (Table 1). Although the length and quality of research varies from lab courses in college, to one or more summer program or volunteer experience in a lab during the academic year, some research experience is necessary to demonstrate the desire and interest in pursuing a PhD in biomedical science. Only about 20% of applicants to UChicago PREP and 14% of applicants to Einstein PREP have prior publications, but preference is not given to matriculants (22% at UChicago and 14% at Einstein) who have previously published their research. Overall, neither the UChicago PREP nor the Einstein PREP accept students who appear to be qualified to enter a biomedical sciences PhD program with their current credentials. In fact, with application deadlines in March (Einstein: March 1; UChicago: March 31), many students apply to these PREPs because they were unsuccessful in getting either an interview or an offer based on their graduate school applications submitted earlier that year.

Table 1. Admissions data: UChicago and Einstein PREP Programs, 2014-2019

Characteristics of PREP applicants and matriculants	UChicago	Einstein
Total applications, n	801	820
Total interviewed, n, %	73 (9%)	69 (8%)
Total accepted, n, %	56 (7%)	69 (8%)
Total matriculants, n, %	40 (5%)	29 (4%)
Average GPA applicants	3.35	3.38
Average GPA matriculants	3.39	3.54
Applicants with publications, n, %	157 (20%)	112 (14%)
Matriculants with publications, n, %	9 (22%)	4 (14%)
MARC/MBRS applicants, n, %	108 (13%)	48 (6%)
MARC/MBRS matriculants, n, %	9 (22%)	7 (25%)
SRP applicants, n, %	484 (60%)	453 (55%)
SRP matriculants, n, %	32 (80%)	21 (72%)
Type of undergraduate institutions for matriculants		
R1 (very high research activity)	11 (27%)	6 (21%)
R2 (high research activity)	4 (10%)	14 (48%)
PUI	8 (20%)	9 (31%)
MSI	17 (43%)	16 (55%)[a]

a. Includes MSI as well as R1, R2 and PUI with high proportions of UR students.
MARC, Maximizing Access to Research Careers program; MBRS, Minority Biomedical Research Support program; SRP, Summer Research Programs; PUI, primarily undergraduate institutions; MSI, minority-serving institutions.

GRE (Graduate Record Examinations) preparation is becoming less critical for graduate school admission; the 2018-19 UChicago PREP Scholars reported only submitting their GRE scores to ~30% of the graduate schools to which they applied. With the GRE preparation offered by the UChicago PREP, this cohort's scores improved by an average of 3.25 points (verbal) and 3.5 points (quantitative). Their final scores averaged 153 verbal (62nd percentile), 153 quantitative (50th percentile), and 4.1 writing (60th percentile), which are typical average scores of past cohorts. While an opportunity for a GRE preparatory course is offered at Einstein, few, if any of the scholars, are utilizing the course.

During our one-year research intensive PREP, scholars can accomplish a great deal in the laboratory. However, depending on the nature of the research and the maturity of the project, it is not common for PREP scholars to publish their recent research while in the program. For example, in the 2018-19 UChicago cohort, one scholar out of eight was on a publication during the PREP year.

Table 2. Scholar outcomes: UChicago and Einstein PREP Programs, 2014-2019

PREP Scholar Outcomes	UChicago	Einstein
Total completed PREP program, n	32	22
Total still in progress in PREP, n	8	7
Total matriculated to PhD, n, %	29 (91%)	19 (86%)
Total matriculated to MD, n, %	1 (3%)	0 (0%)
Total matriculated to MD/PhD, n, %	0 (0%)	2 (9%)
Total deferred , n, %	2 (6%)	1 (5%)
Directly matriculated to PREP home institution, n, %	3 (10%)	2 (11%)
Matriculated to R1 - state university, n, %	15 (51%)	3 (14%)
Matriculated to R1- private university, n, %	14 (49%)	10 (45%)
Matriculated to PhD programs in medical schools, n, %		7 (32%)
Matriculated to university in the UK, n, %		1 (5%)

It is more common for scholars to be recognized as co-authors after finishing the PREP year, thus tracking outcomes of alumni is essential. In the period 2014-19, 12 of the UChicago PREP scholars and 11 of the Einstein scholars have been included as co-authors on peer-reviewed publications, including two who were first authors on their publications (https://bsd-prep.uchicago.edu/ and https://www.einstein.yu.edu/education/phd/prep-program/prep-publications.aspx).

Both PREPs are evaluated at multiple stages and data are analyzed to strengthen the programs. UChicago PREP scholars participate in multiple surveys during the PREP year, and most report finding the PREP experience valuable and rewarding. Activities ranked highest are participation in the PREP workshops, graduate courses, the outreach venues (SACNAS, ABRCMS, Regional and UChicago Symposia), as well as journal clubs. Einstein PREP scholars consistently cite the value of the program. One commented, "Without this program, I would've never understood my potential…From the seminars, journal clubs, scientific meetings to the basic science research, the exposure was unique and vital to my growth as a young investigator." PREP alumni in both programs are surveyed annually and feedback remains similar; all feedback on these surveys is used to improve the program for the future.

Both the UChicago PREP and the Einstein PREP scholars enter graduate school programs across the country (both private- and state-R1 institutions). The proportion of UChicago PREP scholars who subsequently enroll at UChicago's graduate school is about 10%; similarly, only about 11% of Einstein PREP graduates have enrolled in Einstein's PhD program (Table 2). These data show that PREP at these institutions is not serving as an internal pipeline program for the home institution graduate programs (Table 2).

Lessons Learned

Based on experience, observation, and documented feedback from more than 15 years of administering PREP at the UChicago, we have learned several lessons that have prompted changes in the three major components of the PREP: scholars, mentors, and the program. Interestingly, these observations and suggestions are reinforced by similar, parallel experiences in the newer PREP program at Einstein. We have summarized these below.

Scholars

Grit

Just as with graduate school applicants, no assumptions should be made regarding the eventual success of particular individuals, based on evaluation of application materials (GPAs and class percentile rankings, or recommendation letters). Analysis of PREP applications received at UChicago indicates inconsistent correlation between the highest-scoring applicants and their eventual acceptance or success in graduate school. Rather, the individual's personal determination, now termed grit, appears to be an essential (if somewhat nebulous) trait for graduate study.[7,8] Grit may be partially discernible from the letters of reference and written personal statements, but is often observed during the interview process. Therefore, all PREP candidates should be interviewed in-person or, if necessary, by Skype, as is done by both programs.

Tough Love

An attitude of tough love, starting with the orientation sessions, is necessary. The scholars have responsibilities in several spheres (ie, the lab, numerous PREP programmatic activities, academic courses, professional venues, etc.), and answer to several different people for these responsibilities. This requires effort in

time management and distribution of energy that are much more challenging than the undergraduate experiences. During the orientation sessions at UChicago and also at Einstein, we outline the year in a schematic (Figure 1), describing each element of PREP, showing how they overlap, and repeatedly emphasizing expectations for the PREP scholars. Both PREPs are designed as one-year experiences; therefore we expect all scholars to apply to graduate programs during the fall and we provide ample guidance so that they can accomplish that goal.

Personal Responsibility

Personal responsibility is not inherent and must be learned. Therefore, monitoring and oversight are crucial to the success of the PREP scholar. For example, reminders of events are sent to both scholars and mentors, and scholars' progress in their various activities is diligently followed without assuming that everyone is keeping up with their multiple tasks. At UChicago, regular, periodic feedback to the PREP directors from the *Success Skills, Writing, and Journal Club* instructors on individual scholar performance and group participation is essential. In addition, gathering midterm and final grades from academic course instructors is important to determine whether scholars are falling behind or losing interest, and allows us to decide whether to intervene. In the Einstein PREP, scholars attend a biweekly meeting with the PREP directors to develop relationships, assess progress and provide critical feedback and assessment. In addition, the PREP mentors meet at the beginning of the program and then semi-annually to review expectations and experiences and to make suggestions to each other and to the PREP program leadership for improvements.

Flexibility and Customization

PREP must be flexible and customized for each scholar, as each one comes to the program with their own strengths, weaknesses and most effective ways of learning. In addition, we have found that we must pay extra attention to individuals with gaps due to personal or professional challenges in their educational backgrounds.

Both programs have thus far achieved significant success: 91% (University of Chicago) and 95% (Albert Einstein College of Medicine) in the matriculation of scholars into PhD or other higher education programs.

Such scholars need to be followed more closely during the PREP year in order to foster success in the intensive environment of a future graduate program. The Einstein PREP program has found that, in some cases, this individualization process identifies trainees who will need two years in PREP in order to be successful in the graduate school application process and then in graduate school. To date, the few Einstein PREP scholars who remained in PREP for two years have all successfully entered graduate school and are still in training.

Collegiality and Cohort Cohesion

We have also found that providing an environment that promotes collegiality and cohort cohesion impacts scholar success. Weekly group interactions are essential: at UChicago this is fostered by a weekly journal club; at Einstein by bi-weekly group meetings. Scholars both at UChicago and Einstein have a "home base," ie, a program coordinator who works directly with them, organizes the various programmatic activities, and is in constant touch with them. In addition, the PREP scholars at Einstein and UChicago often bond socially via rooming together, developing group chat rooms, or Facebook pages. The cohort size of 7-8 individuals is optimal to promote collegiality and group interactions.

Mentors

Training of the Trainers

Although most mentors are experienced in supervising graduate students and/or postdocs, it has been determined through the evaluation process and scholars' performance that some mentors need more "training of the trainers." In particular, we have found that we must be diligent in ensuring that the mentors' expectations are aligned with the short one-year duration of PREP. This may be accomplished in several ways: 1) providing a detailed "Mentors' Handbook" (UChicago);

2) participating in an orientation session to review the program elements and expectations (both); 3) additional informal mentors' luncheons to share experiences, discuss challenges and review expectations following the written evaluation of the scholars (both); 4) individual consultation between a mentor and the program director (both). Also, we try to place scholars in labs with postdocs or faculty who have had mentor training to enhance sensitivity to cultural issues (an area of increasingly perceived need), or with faculty who have hosted PREP scholars in the past with excellent results. Thus far, very few, if any, scholars have changed mentors during the PREP period, verifying that we have developed effective matching systems, with multiple checkpoints in both programs.

Communications

Frequent and timely communication is essential. The mentor and any senior persons in the lab who may co-mentor a scholar on a day-to-day basis are informed of all scheduled PREP activities, including classes, workshops or travel (to SACNAS, ABRCMS, interviews, etc.). It is especially important to keep in constant personal contact throughout the critical fall period to monitor lab performance, class attendance, PhD application progress and general well-being. The mentors' sessions described above are also essential focal points for communication by both programs.

Acknowledging Contributions

We have also initiated mechanisms to acknowledge the contributions of PREP mentors: certificates of appreciation to the mentors (Einstein) or profiling repeated and/or exceptional mentorship in institutional newsletters and a Mentor-of-the-Year award (UChicago).

Program

One-year Interventions

The PREP programs are designed as one-year interventions, as required by NIGMS since 2007[6] (Figure 1). At UChicago, we have accomplished this for all scholars by dividing the year into blocks and focusing each block on the most urgent tasks related to the graduate school admissions preparation and process. Similarly, at Einstein, the PREP scholars are guided through the year by focusing on specific responsibilities at particular times (Figure 1):

Summer: orientation to lab/research and GRE preparation (if necessary);

Fall: identifying graduate schools, completing applications and taking the GRE (if necessary), participating in ABRCMS (all Einstein PREP Scholars) or SACNAS are required for both programs and include presentation of a poster if appropriate;

Winter: the graduate school interview process, mock interviews practice (to develop necessary skills in speaking about their scientific research);

Spring: preparing for the transition to graduate school; focusing on further skill development, ie, grant proposals, public speaking in preparing for an annual symposium, etc.

Basic Lab Techniques

The Basic Lab Techniques course has been found to be essential at UChicago. Some PREP scholars have little bench-research experience and even scholars with summer research experiences or part-time research during college are often lacking the theoretical understanding of the techniques they used for their past projects. In 2010, a week-long mandatory course that covers theory and methodology was instituted. For those scholars who lack a strong quantitative background, we now extend the course with additional quantitative skills-building material, including exposure to rigor and reproducibility in data management. The mentors note that the scholars are now better prepared to delve into a research project when they join a lab. Similarly, at Einstein all the PREP scholars participate in the 1st year graduate course, Quantitative Skills for the Biomedical Researcher, to learn principles of experimental design, statistical analysis of data, and skills necessary for rigor and reproducibility in scientific research.

Lab Rotations

Mini-lab-rotations have become the norm at the UChicago PREP. Scholars may rotate through one or two labs, for a maximum of two weeks each, before deciding which mentor, lab environment, and research project is the best choice for that individual. Since scholars have been doing rotations, they have been satisfied with their choices and none have changed labs. Although there are not formal rotations for PREP Scholars at Einstein, PREP scholars may "try out" a lab for one or possibly two weeks before choosing that laboratory.

Scholarly Literature

Mastering primary literature has also become a major focus in

the UChicago PREP. Scholars rotate presenting each week through a year-long, journal club that starts in the fall with discussions of the latest journal articles of general interest chosen by the instructor, followed by scholars choosing papers of relevance to their research project areas as the year progresses. Similarly, at Einstein, the PREP scholars are encouraged to participate in the 1st year PhD Bootcamp, which includes discussion of lab techniques and skill-building in reading and assessing scientific papers. In addition, the Einstein PREP scholars attend the EMSA (Einstein Minority Scientist Association) journal club to work with advanced graduate students and postdocs on reading the scientific literature. Scholars report back that learning and practicing how to effectively and efficiently digest and process a scholarly journal article in a timely manner is critical to successfully managing course work in graduate school.

Number of Scholars

Although the number of positions has been maintained at eight at the UChicago and seven at Einstein, sometimes postbaccalaureate scholars funded by minority supplements have joined the scholar group for workshops and social events. We have found that seven to eight is a good size to maximize the number of participants while maintaining cohesiveness and oversight of all PREP scholars.

Reality Check Session

The attention provided by the program and camaraderie developed by the PREP scholars can induce a false sense of security. When scholars leave the PREP and enter various graduate programs, they report back significant "culture shock" at how little individual or collective attention they receive in their new graduate programs. This reality requires PREP scholars to learn to readjust their expectations and rapidly acquire greater independence. Thus, at UChicago, we introduced a year end "reality check" session at which current graduate students cover such topics as how to navigate the first year of graduate school, ie, academic expectations, rotations, time management, advocating for self, knowing when to ask for help, etc. This mitigates independence shock, enhances persistence, fosters academic success and instills identity as a scientist. An analogous program is currently under development for the Einstein PREP, which in addition to the elements mentioned above, will also feature discussions on how to make the most of a seminar and how to engage in a scientific discussion.

Participation of the PREP Leadership

A considerable commitment of time and dedicated effort by the program leadership is critical to the success of the scholars and the PREPs. Most PREP directors report anecdotally that the time necessary for individualized program development and continuous monitoring and mentoring of PREP scholar progress far exceeds any estimates. This is a true investment in the future diversification of the biomedical workforce and if viewed as such, then the substantial efforts required for a successful program are well-rewarded.

Conclusions

The results described here are from two PREP programs, one, which is more mature (16 years) at the University of Chicago, and the other more recent (6 years) at Albert Einstein College of Medicine. While each program has unique features specific to their particular cohort of PREP scholars and the differing institutional cultures and environments, there are important similarities such as: the design of the programs; consistency of recurring interactions between the PREP program directors and the scholars; academic enrichment activities; and, most importantly, expectation setting and monitoring of scholars and mentors. Both programs have thus far achieved significant success: 91% (University of Chicago) and 95% (Albert Einstein College of Medicine) in the matriculation of scholars into PhD or other higher education programs. The results exceed the average national rate of 65% matriculation calculated for all PREPs through 2015.[6] The success rate achieved here underscores the importance of a thoughtful, well-designed and sustainable year-long intervention to encourage and support, both academically and financially, UR students who are interested in science but may not be, for a variety of reasons, prepared to enter PhD programs. PREP is one approach that appears to work well, has been scaled nationally, and has already led to increased diversity in the biomedical workforce.

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Conflict of Interest

No conflicts of interest to report.

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