
Improving Diversity in PhD Programs in the Biological Sciences at USC

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Reviewed March 24, 2009

During the 1990s, approximately 19% of the undergraduate Biology majors at the University of South Carolina were African American. However, African Americans represented only 2-3% of the students pursuing PhD degrees in the biological or biomedical sciences. To correct this imbalance, USC initiated an effort to increase minority participation through focused recruiting and to increase funding opportunities for minority graduate students. A guiding principle has been that success breeds success.

Undergraduate Research

Undergraduate research is a critical component of science education because research is the primary enterprise of science. Unfortunately, many students complete high school thinking that science consists of learning new terms and memorizing irrelevant facts. When students participate in scientific research, they learn the true meaning of science. In addition, the laboratory environment is much like a family business where everyone helps each other to make the business successful. Therefore, it provides a nurturing support system that helps students from strong educational backgrounds thrive. However, for first generation college students, inclusion in a laboratory research group can be a lifeline. College can be intimidating if you do not know how the system works and you are out on your own for the first time. If you work in a laboratory, there is a place where you belong, a place where people care about you and show you how to be successful. It is a place where good work is rewarded with praise, and students discover the true nature of science. Thus, for many students participation in a laboratory research group can be a critical component that is important for academic success.

Hughes undergraduate research program

The Hughes undergraduate research program was initiated in 1993 with a grant from the Hughes Foundation to the USC Department of Biological Sciences to provide research opportunities for biology undergraduates. The program was so successful that when the grant ended, the university administration committed funds to make the program permanent. Since that time the program has been replicated in several other departments at USC, and the university has made undergraduate research a university-wide priority. In fact, USC has established an office of undergraduate research to promote undergraduate research participation throughout

USC. To enhance the prestige of undergraduate research, the Office of Undergraduate Research hosts Discovery Day where undergraduates present their research and compete for cash prizes. In addition, undergraduate students are encouraged to submit proposals for prestigious, university-funded Magellan grants to fund their research projects.

NSF Research Experiences for Undergraduates (REU)

Funding for an REU program in the biological sciences has been provided by the National Science Foundation since 1999. This program provides support to bring 12 undergraduates to USC from schools throughout the US for a nine-week intensive research experience. More than 100 students apply for this program each year, and approximately one third of the participants are minority students. The existence of the REU program also helps leverage funding for additional students since faculty can request support for undergraduate research stipends on their research grants and add students to the REU program. To date, five REU participants have returned to USC for their graduate work after completing their undergraduate degrees.

Research Access for Graduate Success (RAGS)

With funding from the National Institutes of Health (NIH), the USC Department of Biological Sciences initiated the RAGS program to provide funding for interested minority students to join research laboratories during their freshman or sophomore years. Traditionally, undergraduates have waited until they have completed their sophomore level core courses before joining a research laboratory. The RAGS program encourages early research participation so that the students can reap the benefits of belonging to a laboratory research group as soon as possible. To date, each of the RAGS students has been able to give up off campus employment as a

result of RAGS program participation. Thus, time that was previously spent in the retail sector is now being used to enhance their education and allowed them to make better use of their study time. RAGS students meet as a group twice per month to share their research experiences, learn strategies for doing well in their courses, read scientific papers, and receive help with applications to graduate school. They are required to write a research proposal early in their program and then write a research thesis during their senior year. The current RAGS students have reported that both their self-confidence and their grades have improved since joining the RAGS program.

Strategies to increase minority enrollment in PhD programs in the biological sciences

PREP, a bridge program to graduate research

Many minority students come from disadvantaged backgrounds. As a result, they find that they are always trying to catch up to their better prepared peers. Even after they finish their undergraduate education, many talented minority students are not adequately prepared for graduate school. The NIH-funded USC Post-baccalaureate Research Education Program (PREP) is designed to serve as a bridge program to address this problem. Students chosen for the PREP have completed their undergraduate degrees, but they are not ready for the rigors of graduate school, and often, they do not have the credentials needed for graduate school acceptance. As part of PREP, scholars are employed as full time research technicians in a mentor's laboratory and have the opportunity to take one class each semester. Each student has a unique program tailored to his or her needs. The courses they take are chosen to fill holes in a particular student's background and to provide them with the opportunity to demonstrate that they can succeed in graduate level courses. If a PREP scholar does well in both her graduate courses and her research project, and is recommended by her mentor and the PREP program directors, she is guaranteed acceptance into one of the USC biomedical science graduate programs. Our experience is that most PREP scholars get involved with a research project and continue to work on it for their dissertation research after entering a doctoral graduate program. To date, nine minority students have transitioned from PREP to PhD programs at USC (figure1).

Support for minority PhD students

A second strategy for increasing minority participation in PhD programs has been to obtain additional sources of financial support. Minority students tend to have lower scores on standardized tests such as the GRE, and consequently, they have trouble competing for acceptance into PhD programs. However, research has shown that GRE scores are poor predictors of academic success. Therefore, the availability of funds to support minority graduate students provides an incentive for PhD programs to accept otherwise qualified minority students, in addition to the other students who are admitted to the program. As a result, the percentage of minority students in the PhD program increases without impacting the students who would normally have been accepted to the program. This increased minority participation, in turn, attracts additional qualified minority students so that the pool of applicants improves as well. Our follow up data show that once accepted into the PhD program, minority students with good credentials, but poor GRE scores, perform as well or better in their courses than the graduate students with higher GRE scores.

One important source of support for minority graduate students has been an Initiative for Minority Student Development grant from the National Institutes of Health. This grant provides funds that allow minority students who have not participated in PREP to come to campus during the summer prior to the start of their doctoral graduate program. This early start enables the student to get started on a research project in a mentor's laboratory and get settled in Columbia prior to the start of the fall semester. In addition, they are awarded a research assistantship so that they do not have any teaching responsibilities during their first semester. This combination of an early start and reduced responsibilities reduces the stress of their first semester in graduate school and helps ensure that the student will be successful. The Sloan Foundation also provides funds to help minority students successfully complete their doctoral programs, and the students are encouraged to apply for scholarships from other funding sources as well. To date, all minority students accepted into doctoral programs in the biological sciences have had sufficient support to enable them to complete their PhD degrees.

Results

In recent years, the research environment in the biological sciences at USC has been transformed. Enrollment in PhD programs in the biological sciences has increased by 30% and minority students now comprise more than one fourth of the total. This six-fold increase in minority enrollment in the PhD programs combined with a similar increase in minority undergraduate research has resulted in an environment where students from all ethnic groups feel included and supported. Since substantial numbers of foreign-born students and faculty participate as well, the atmosphere is truly multicultural and transcends differences resulting from ethnicity or culture. This success at improving diversity has led to a larger and more diverse applicant pool which will continue to improve the quality and diversity of students in the biological sciences at USC. Success breeds success.



Figure 1. The Ely Research group: a picture of diversity. From left to right, Jinxian Liu, Vida Mingo, Kurt Ash, Margo Saunders-Mack, Bert Ely, Melissa Eldridge, Amerline Occean, Julius Hamilton, and Jeremy Dietrick