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Undergraduates

Community Colleges Fuel Science Workforce

Siri Carpenter
United States
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When he graduated from high school, Roberto Tinoco didn't really know what his options were for further education. Tinoco, whose family emigrated from Mexico to California when he was a child, had a 1-year-old daughter to support. "I was a young dad. I had all these responsibilities at home, and a lot of people told me that maybe I should give up school so that I could support my family," Tinoco remembers. So he found a job as a check-cashing teller. The business's owner had once been a minority-mentoring coordinator at the University of California (UC), Davis, and she believed Tinoco had potential. "She helped me realize that I still had to take care of my education and that there are opportunities out there for me," Tinoco says.

With his boss's encouragement, Tinoco enrolled as a biology major at Mt. San Antonio College, a 2-year school in Walnut, California. After 2 years of studying hard, getting laboratory

experience, and working full-time, he applied to six UC campuses and was accepted by all of them. "I was amazed at the level of recruitment these universities have at community colleges," he says. He chose UC Irvine, persuaded largely by a minority scholarship offered through the university's NSF-funded [California Alliance for Minority Participation](#) (CAMP) program. Now a third-year Ph.D. student in viral immunology at UC San Diego, Tinoco advises students following a similar path to "stay focused on obtaining your goal and surround yourself with people who care about helping you in your education."

"For aspiring researchers, community colleges are an attractive way to begin one's scientific training."

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Tinoco's success in moving from a 2-year college to the scientific mainstream reflects both his exceptional tenacity and his good fortune in meeting the right people. But he is no fluke. "There is a huge pool of talent to tap at the community colleges," concludes Shiva Singh, program director for [NIH's Bridges to the Future](#), an initiative aimed at increasing minority participation in bioscience. Students at the nation's 1200 community colleges account for almost half of all U.S. undergraduates, and more than a third of them are black, Hispanic, American Indian, or Asian/Pacific Islander--minority groups underrepresented in science. "If we can provide community college students with the proper guidance and mentoring to take the right courses, in the right sequence, they can be competitive at the university level," says Singh.

FORGING PARTNERSHIPS

According to a study by the U.S. National Science Foundation (NSF), 48% of people who received a bachelor's or master's degree in science or engineering in 2004 or 2005 had attended a 2-year college at some point. Most underrepresented minority students begin their journey in higher education at community colleges, and minority Ph.D. holders across all fields are more likely than whites to have begun their careers at a community college. Mexican Americans are especially likely to start at a community college: 23% of Mexican Americans with doctoral degrees began their postsecondary careers at a community college.

"I've been a faculty member for over 32 years, and students who came out of the community colleges are among the best scientific talent that I have known in my professional career," says Juanita Barrena, a professor of biological sciences at California State University, Sacramento, and principal investigator for her university's Bridges to the Baccalaureate grant, an arm of the U.S. National Institutes of Health's (NIH's) Bridges to the Future initiative. "Were it not for the community colleges," Barrena says, "those students would not now have completed their Ph.D.s or even be ready to apply to Ph.D. programs. Those students would have been lost to the scientific enterprise."



Jamie Merisotis

Data are elusive on how well community colleges do at shepherding interested students into research careers. No one systematically tracks the nation's community college students after they transfer to 4-year schools or measures how many go on to get advanced degrees. Numerous federal agencies that historically have focused their minority recruitment and retention efforts on universities, including NSF, NIH, and the Department of Education, are now implementing or expanding programs to fortify science education at community colleges, to facilitate 2-year students' transfer to universities, and to encourage those students to continue toward advanced degrees.

"American higher education is recognizing that community colleges are critical partners in fueling the scientific enterprise, not merely way stations until students get to the 4-year institutions," says education policy analyst Jamie Merisotis, president and CEO of the Lumina Foundation for Education in Indianapolis, Indiana. Merisotis is regarded as a leading expert on education policy, including issues of access to higher education for underrepresented minorities.

NIH's 10-year-old [Bridges to the Baccalaureate](#) program, for example, spends \$8 million a year to support partnerships between 2-year and 4-year institutions, providing money for institutional coordination, facilities, tutoring, peer mentoring, seminar series and workshops, and summer research opportunities for community college students. (Its companion, dubbed [Bridges to the Doctorate](#), takes over from there. Both programs are cosponsored by NIH's National Institute of General Medical Sciences and the National Center on Minority Health and Health Disparities.)

Early research opportunities are critical, many science educators believe: A 2007 study found that undergraduates who participate in laboratory research are significantly more likely to pursue advanced degrees in science and engineering than those who don't get hands-on research experience. In addition to building technical and critical-thinking skills, a laboratory berth broadens students' understanding of what science is and provides a "passport" to the scientific community, says Kika Friend, who directs the CAMP program at UC Irvine. For

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community college students, working in a research lab means that "instead of flipping burgers to make ends meet, you become part of the culture of research," Friend says. "To have a faculty member take interest in what you're doing, to be given the key to the lab, and to be part of a team reinforce that sense that you can do it."

A PROMISING PATH

For aspiring researchers, community colleges are an attractive way to begin one's scientific training for many reasons. On average, community college tuition and fees are 38% of those at 4-year institutions. Local community colleges often are preferable for students with family or job obligations. And compared with research universities, community colleges offer smaller classes on average--especially in the big survey courses that dominate the first 2 years of a college education--and provide more opportunities for individual attention from professors. Stephen Summers, chair of the physical sciences department at Seminole Community College near Orlando, Florida, says that science classes there are capped at 24 students. "That intimate classroom environment is more conducive to students' success than are university lecture halls that seat maybe 450 students," he says.



Kika Friend

In addition, 30% of students who enroll at community colleges require remedial instruction, especially in math and English. Remedial courses are becoming scarce at universities but remain one of community colleges' strengths, Summers says.

Community colleges are also equipped to provide English language training for immigrant and refugee students, so they are a good starting point for strong students with weak skills in spoken and written English. That was a critical component for Veder Garcia, whose family moved to the United States from El Salvador when he was a teenager. When he finished high school, Garcia says, "my English was not good enough to obtain an acceptable score in the exams, such as the SAT, required for applying for admissions at a 4-year institution." During a 2.5-year stint at Montgomery College in Rockville, Maryland, Garcia's English skills flourished, and he completed the general science courses necessary to transfer to the University of Maryland, College Park. Now a graduate student in plant and microbial biology at UC Berkeley, Garcia believes that the teaching and mentoring he received while in community college was essential to launching his scientific career.



Stephen Summers

Still, would-be scientists who start out at a community college have some barriers to climb. In addition to the educational deficiencies that frequently frustrate students' progress, students sometimes have difficulty finding out what credits will transfer to a university. Community colleges also tend to have less funding per student than universities do, so the quality of academic offerings sometimes suffers. Finally, opportunities to participate in hands-on research are scarce at community colleges, so students looking for lab experience typically have to look elsewhere.

Given these obstacles, it's not surprising that, although about half of all enrollees enter community college intending to transfer to a 4-

year institution, only about 25% actually do--a gap that programs such as NIH's Bridges to the Baccalaureate and NSF's [Louis Stokes Alliances for Minority Participation](#) aim to remedy.

Students who make it that far must clear more hurdles after they enter a university. Many transfer students work full-time while attending school, before and after they transfer. And even students who received solid mentoring at a community college, and who are academically well prepared, may find the faster pace of university life unnerving. "We have a saying in Spanish,"

says Friend. " 'Until you're in the bull ring, you don't realize the magnitude of being a bullfighter.' "

On the other hand, students coming from community colleges are often better prepared to fight the bull. They're often older, more mature, and more committed to their education than students who enter the university right out of high school, says Derek Dunn-Rankin, faculty director for California's statewide CAMP program and a professor of mechanical and aerospace engineering at UC Irvine. He notes that transfer students tend to have higher graduating grade point averages than their "native" counterparts. "The community college is a selective filter," he says. "The students who are dedicated enough to get through a community college experience while juggling a job, a family--all of the things that kept them out of a 4-year college to begin with--are special people."

OFF TO A SMART START

Geographic considerations often constrain students' choices of community colleges, but if you're interested in pursuing science courses, it's wise to investigate a school's commitment to the field. Talking to a college's science department chairs often reveals whether the school has worked to develop a strong curriculum and facilities. If it's hard to find a science department on the college's Web site, that's probably not a good sign.

When gathering information about schools, consider these questions:

- Does the school have specialized science departments rather than one all-inclusive science department?
- Are requirements for transferring into 4-year programs clear?
- Does the school highlight resources for math and science education, such as tutoring and mentoring programs or science seminar series?
- Does the school provide modern teaching labs, equipment, and software?
- Do science students have opportunities to gain real-world research experience through individual or institutional partnerships with faculty members at universities?
- Does the college participate in any federal, state, or privately funded programs designed to help science students complete their 2-year programs and succeed at the university level?
- Can faculty members at the community college point to former students who have gone on to promising scientific careers?

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Comments, suggestions? Please send your feedback [to our editor](#).

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