



# Undergraduate Research at Community Colleges

## The Search for Synergy: Undergraduate Research at the Community College

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*Undergraduate research is not only the essential component of good teaching and effective learning, but also ... research with undergraduate students is in itself the purest form of teaching (Research Corporation and Doyle 2000).*

The American Association of Community Colleges (AACC) reports that as of January 2007 an estimated 6.5 million students were enrolled at a community college (2.7 million full-time). Accounting for approximately half of the U.S. postsecondary population, these large enrollment numbers highlight the increasing impact that community colleges are having on postsecondary education in the United States. The impact is equally dramatic when considering the role that community colleges play in the education of students in science, technology, engineering and mathematics (STEM) disciplines. In 1999 and 2000, close to half of the more than 740,000 graduates earning bachelor's degrees in STEM disciplines had attended a community college (NSF/SRS 2004).

The role of community colleges in undergraduate education is even more prominent for students in specific underrepresented groups. More than half of Native American and Hispanic undergraduate students are enrolled in community colleges (NSF/SRS 2003). These statistics suggest that any broad-based plan to reform undergraduate science education must rely heavily on the capacity of community colleges to implement that reform. In order to realize progress, initiatives to increase the number of students from underrepresented groups pursuing advanced degrees in science and engineering must acknowledge the important role of community colleges.

Literature on the reform of undergraduate science education is extensive, and reports from a variety of organizations have focused on some common recommendations, including the importance of integrating inquiry-based methods of teaching and research experience into undergraduate education. Central to the reform movement is the idea that learning science should be an active endeavor that focuses on science as a process (NSTA, 1996). Conceptual understanding of scientific principles can be enhanced through inquiry-based instruction and problem-based learning strategies (NRC, 2000). Reform should involve the integration of an undergraduate research experience as early as is practical in the education of STEM students (NRC, 2003b). In addition, the reform must include a well-defined strategy of assessment that involves evaluation tailored to the specific mission and student demographics of the institution (NRC, 2003a).

Taken together, the recommendations make clear that community colleges must take a leadership position in implementing reforms that involve the integration of inquirybased instructional models and undergraduate research. While educators may agree on why this type of reform must occur, the significant challenges and barriers related to community colleges raise the essential question of how such reform will actually take place. Many of these barriers are unique to the community college as an institution, and effective models of integration and implementation are lacking. A review of the development of the undergraduate research program at Finger Lakes Community College (FLCC) in Canandaigua, NY, illustrates the challenge of implementing undergraduate research in community colleges. Our efforts had a modest beginning, and the story is full of serendipity, dead ends, naysayers, but, most importantly, examples of student success.

In 2001, Finger Lakes Community College began an Associate of Science Biotechnology Program in response to an increase in demand for high-tech employees from a growing biotechnology industry. While the program began with only five students, an investment in laboratory space and instrumentation soon followed and continued over the next few years

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with support from industry and funds from the National Science Foundation (NSF). While four-year colleges frequently rely on the research labs of their faculty members to support undergraduate research programs, community colleges are often asked to use teaching labs for undergraduates' research. In many cases, these labs are ill-equipped and over-utilized. Although not specifically designed to support an undergraduate research program, the investment in the biotechnology program at FLCC was the beginning of several years of important infrastructure and capacity building. The infrastructure associated with the new technical program was a key element in the "butterfly effect" that soon followed. However, it would be several more years before a formal undergraduate research program would be envisioned, based on the lessons learned during the early stages of this pedagogical journey. In hindsight, in fact, it is clear that undergraduate research at FLCC began as an alignment of several seemingly unrelated events.

Ironically, the beginnings of a formal undergraduate research program at FLCC can be traced to a scientific question exchanged during a chance encounter between two faculty members in 2001. Anne Schnell, associate professor of environmental conservation and a volunteer for Braddock Bay Raptor Research (BBRR), was wrestling with an important problem related to BBRR's raptor-banding program. Records sent to the Federal Bird Banding Laboratory on Red-tailed Hawks did not contain information on the sex of the individual birds released with bands. While most raptors are sexually dimorphic, the Red-tailed Hawks lack this characteristic.