



Minneapolis Community & Technical College

Minneapolis, MN

- **IPEDS enrollment, Fall 2010:** 10,545
- **Type of community:** Urban
- **Number of campuses:** 1
- **Number of chemistry students:** 2,000; plus 150 biotechnology students
- **Number of full-time chemistry faculty:** 4; plus 2 biotechnology instructors
- **Number of adjunct chemistry instructors:** 5–7
- **Structure:** Chemistry and Biotechnology programs are part of the Science Division
- **Focus of chemistry and biotechnology programs:** Transfer, A.S. degrees, and employment
- **Sections of the Guidelines used:** 4.1, 5.10

Rekha Ganaganur, a chemistry and biotechnology faculty member of the Minneapolis Community and Technical College (MCTC), along with chemistry department faculty members Kirk Boraas, Lijin Shu and Wendy Naughton, used the *American Chemical Society (ACS) Guidelines for Chemistry in Two-Year College Programs* to transform MCTC's chemistry and biotechnology programs. Beginning in 2004, Ganaganur has served as the faculty lead for developing the associate of science transfer degrees in chemistry and biotechnology. The chemistry and biotechnology faculty members helped plan the new science facility, where chemistry classes are limited to 18 students. The faculty used the ACS Guidelines to:

- Advocate for a new associate of science degree in chemistry and the competencies introduced in the biotechnology curriculum
- Expand course offerings
- Influence the design of and equipment selection for a new Science and Allied Health Building

When the MCTC biotechnology program was being developed in Spring 2005, Ganaganur and her colleagues wanted to move the chemistry department beyond offering a few transfer courses. They envisioned adding new courses and implementing a chemistry associate of science (A.S.) degree program. These curricular changes were not possible with the two chemistry labs and limited equipment they had at the time.

Updating Facilities and Curricula

The process of reviewing and updating began when MCTC administrators wanted to boost momentum in the sciences. They also shared the science faculty's interest in new curricula and facilities. In 2005, the administration and faculty began planning a new associate of science degree in biology and a new program in biotechnology.

"From my experiences as a researcher and industry scientist in both chemistry and the biosciences, it was very clear from the beginning that it was important to strengthen the chemistry ... at the same time [we developed the biotechnology program]," Ganaganur explained. Results from a survey of biosciences industries and suggestions from the college's industry advisory council both mentioned chemistry skills that should be part of the new biotech program.

In this context, Ganaganur proposed a new associate of science chemistry degree to then-Dean Janis Hollenbeck. The dean agreed that having both chemistry and biotech would allow students to pursue both majors and meet the transfer requirements for multiple disciplines.

Administrators were "very receptive" to using the ACS Guidelines to plan the new programs, agreeing that the Guidelines would help with accreditation and add value to students' credentials. Then the formal Minnesota State Colleges and Universities (MnSCU) process began. In addition to a series of presentations at multiple academic administration levels, it required a transfer agreement with at least one MnSCU institution. However, the courses,

skills, and competencies that industry employers seek often vary from the requirements of traditional four-year programs. Careful planning based on the ACS Guidelines and the completion of the new science facility allowed MCTC to introduce a unique set of courses, which meet both transfer program and industry needs. The college has established articulation agreements with several institutions and is completing negotiations with the University of Minnesota.

Influencing the New Building's Infrastructure

While college leaders obtained a \$20 million construction bond from the state government, the chemistry, biotechnology, and other science faculty worked on a planning committee to shape the architecture and infrastructure of the new science building. Ganaganur says the committee used the Guidelines almost as a checklist for the fume hoods, biosafety cabinets, safety features, bench space, and instrumentation for the new laboratories. Advice from MCTC's industry advisory board, Department of Labor publications, and BIO-Link (the National Science Foundation-funded Advanced Biotechnology Education Center) also influenced their thinking, along with reviews of other relevant entities' recommendations.

Ganaganur compared planning meetings to negotiating sessions, most notably regarding the faculty's requests for the square footage of the labs, the number of fume hoods, and instrumentation space. Although these requests complied with the ACS Guidelines, they somewhat exceeded Minnesota's standard for two-year colleges. MCTC faculty also had to explain at length their requests for a walk-in cold room, dark room, and cell-culture room for the biotechnology program.

The chemistry and biotechnology faculty successfully advocated for lowering the faculty-to-student ratio to 1:18 by explaining that it was in the students' best interests. While this ratio is lower than what is recommended in the Guidelines, Ganaganur explained, "We have a lot of urban and immigrant students who do not necessarily come to college ready for these courses...They need a lot [of] additional support and supervising in the labs," Ganaganur said. She noted that faculty advocated for fewer students in the lab because MCTC does not employ teaching or lab assistants. The faculty has to supervise all the students directly while attending to safety and dealing with any issues concerning students' limited fluency in English.

In the new Science and Allied Health Building, the instructor's station and instrumentation occupy a central area in each lab to ensure a commanding, unobstructed view of the entire room. All the students' benches are in full sight of the instructor. The fume hoods are located on the periphery. The Chemistry Department's section of the building includes three dedicated labs, a preparation area, and chemical storage area. Because they are essential to the biotech program, the organic chemistry and microbiology labs are strategically located next to the biotechnology facilities. They, in turn, include a dedicated biotech lab, a cold room, a dark room, a cell-culture room, a preparation room for the labs, and a central instrumentation room.

The college provided the initial funding to build and equip the new labs from the state bond and its regular operating budget. Then the high quality of the programs quickly gained the support of MnSCU and local industry leaders, who helped Ganaganur obtain several grants and corporate support. In recent years, the programs have successfully leveraged this recognition to build partnerships with more employers, professional associations, the

region's universities, and key organizations outside Minnesota.

Within MCTC, chemistry and biotechnology faculty members have used the cross-disciplinary aspects of their courses to collaborate with other departments. Faculty applied for and received excellence award funds to infuse interdisciplinary content and activities across multiple departments. Ganaganur has also held workshops for high school teachers and faculty members from two-year and four-year colleges on several topics. She has also submitted several grants with four-year universities.

Since the introduction of the new courses and the A.S. degree programs in biotechnology and chemistry, and the opening of the new science facility in Fall 2008, enrollments have increased tremendously. Additionally, many faculty from other colleges have called, e-mailed, or visited MCTC to learn about its programs and the lab facilities' design. For instance, approximately 70 people from the National Association of Biology Teachers' conference toured the campus labs during their meeting in Minneapolis.

Involving Students in Research

"In terms of curriculum, we again followed the ACS Guidelines, because how we developed and built the labs also had a direct effect on what kind of curriculum we can or cannot have," Ganaganur explained.

The MCTC chemistry and biotechnology faculty made a point of aiming for the recommendations for ACS-approved baccalaureate and chemistry-based technology programs. They wanted the rigor of their courses to match the expectations both of the four-year programs into which a majority of MCTC students transfer and of employers who hire technicians. Their curricula also incorporate ACS recommendations for laboratory safety skills, as well

as Occupational Safety and Health Administration regulations and the Food and Drug Administration's regulations. By meeting these multiple regulatory and quality control expectations, the faculty intended to prepare students for employment—either immediately or eventually—in a wide range of settings. The chemistry and biotechnology programs also combine Program Learning Outcomes and the assessments referred to in the ACS Guidelines with industry guidelines.

The ACS Guidelines helped MCTC launch respected programs in chemistry and biotechnology, which are housed in carefully thought-out laboratory facilities. The labs, the program's academic rigor, and the addition of an undergraduate research method course make it possible for MCTC faculty and students to collaborate on research projects and continuously seek other research opportunities. Examples include;

- MCTC students now participate in NSF-summer Research Experiences for Undergraduates (REU) programs at multiple universities. Ganaganur has re-established NSF-REU partnerships with University of Wisconsin, Eau Claire, and is in the process of establishing similar partnerships with other universities.
- A new NSF-supported partnership with Cold Spring Harbor Laboratories, a bioscience research institute in Cold Spring Harbor, NY, along with BIO-Link, will enable Ganaganur to introduce other research projects at MCTC and to host and co-teach workshops for faculty from other institutions.
- Newly hired faculty and Ganaganur have attended a Council on Undergraduate Research workshop and have teamed up to

develop the MCTC–Undergraduate Research Initiative.

Ganaganur has several reasons for involving students in research. She wants to provide early research opportunities to students who are interested in this career path. She also wants to give students who plan to enter the workforce after completing two-year degrees the advantage of real laboratory work experiences so they can list this experience on their resumes when they apply for employment in commercial and academic labs.

However, the key reason she seeks to involve associate-degree students in research is that it helps them become more competent and more capable when they enter the workforce, even if it is not until after they complete baccalaureate degrees. Ganaganur has found that having students do research is the best way to help them overcome their fears of working independently in the lab.

The content of this case study was provided by Rekha Ganaganur. She has been a member of the science division at MCTC since 2004 and is the lead faculty member of the biotechnology program. She earned bachelor's and master's degrees from the University of Mysore and a Ph.D. from Bangalore University, India. She had several years of postdoctoral research, industry, and teaching experience before joining MCTC. She is one of 12 US faculty leaders who are co-teaching Bio-Link's Genomics in Bioscience program. It provides genetics education workshops developed by the Cold Spring Harbor Laboratories: Dolan DNA Learning Center for secondary and college educators.