COVER STORY: Inquiring Minds
Monday, October 28, 2013 - By Paul Bradley

Under the supervision of Director Charles Norona (standing), Miami Dade College students work in the college’s Computing Research Lab.

COVER STORY

Inquiring Minds
College Research Opportunities Propel STEM Careers
By Paul Bradley

Community colleges at first glance may not appear to be likely hubs for meaningful scientific research.

The colleges enroll cadres of students who are often unprepared for college-level work. Associate degree completion rates remain paltry. Smaller schools often lack the capacity to apply for and manage grants that can fund such research activities. Faculty often don’t have the incentive or time to develop proposals and manage grant projects. Colleges sometimes don’t have expertise or experience in writing successful grant applications.

But that is gradually changing. The National Science Foundation is spearheading a major effort to increase the number of community colleges qualifying for grants and conducting scientific research on their campuses. Such work, the NSF believes, might not lead to a raft of new inventions, but it can increase the number of graduates in the STEM fields, improve overall graduation rates and forge stronger ties between community colleges and their university partners.

Community colleges are currently managing more than 400 NSF grants with a value of more than $350 million. While those numbers seem impressive, they represent only about a quarter of the nation’s 1,200 community colleges. The NSF wants to expand grant opportunities.
Grants are available in several areas, including:

- The Advanced Technological Education (ATE) program, which focuses on preparing technicians for careers in high-tech fields that drive the nation’s economy. Grants support technician education and faculty professional development.

- The Louis Stokes Alliances for Minority Participation (LSAMP) program supports efforts to increase the number of students who successfully complete high-quality degree programs in STEM disciplines. The program emphasizes strategies and experiences for student groups that have historically been underrepresented in STEM disciplines.

- The Research Experiences for Undergraduates program involves students in ongoing research either on campuses or as supplements to ongoing NSF-funded research. The award pays a stipend and living expenses for students to engage in research, usually during the summer.

Those and other grant programs underscore NSF’s belief that community colleges are both the nation’s leading source of education for scientific technicians and the places where many engineers, scientists, teachers and other STEM professionals begin their academic careers.

NSF has a goal of increasing the populations of students who traditionally have been underrepresented in the STEM fields: women, students of color, and low-income students. The agency believes that undergraduates who participate in hands-on research early in their academic careers are more likely to pursue advanced STEM degrees and careers.

Studies have underscored this assertion. The American Association of Colleges and Universities has identified undergraduate research as a high-impact practice that boosts students’ knowledge of culture and nature, strengthens intellectual and practical skills and deepens personal and social responsibility.

Examples of community colleges embarking on cutting-edge scientific research are growing.

In Virginia, a partnership consisting of four community colleges, the Virginia Space Grant Consortium and the Virginia Geospatial Extension Program was awarded an $899,870 grant earlier this year by NSF’s ATE program to support the education and training of geospatial technicians.

The colleges involved are Thomas Nelson Community College, Virginia Western Community College, Southwest Virginia Community College and J. Sargeant Reynolds Community College.

The project, administered by the Virginia Space Grant Consortium, will establish academic pathways in geospatial technologies — they include fields such as geographic information systems, global positioning systems and remote sensing — at the partnering community colleges. These academic pathways are intended to serve as model programs for other community colleges in Virginia and around the nation. Grant activities get under way in January.

“The grant provides scholarships and internship opportunities for students, dual enrollment opportunities and support for local high school teachers and training for community college faculty at TNCC to integrate geospatial technologies into their curricula,” said Chérie A. Aukland, head of the college’s GIS program. “Unique distance learning courses are in development that will connect
students with faculty mentors from across the state."

In Washington state, Bellevue College was awarded a $550,000 NSF grant to fund a project that is changing the way biology is taught at state community colleges. By immersing students in the actual practice of scientific research, the project aims to boost the number of students who pursue STEM majors and careers.

The effort is based on a program created at Bellevue in 2007, called ComGen: Community College Genomics Research Initiative, considered a pioneering community college research projects. Students perform original research by sequencing the genome of a bacterium that fights a wheat fungus. They also analyze primary research articles and interact frequently with scientists, according to the Bellevue Reporter.

“Our students at BC have really benefited from the opportunity to perform real research and then share it with the wider scientific community. They gain a much better understanding of biology compared to just doing recycled lab exercises,” said Principal Investigator and Assistant Dean of Sciences Gita Bangera.

Said Rob Viens, Ph.D., dean of BC’s Science Division: “Ultimately, this project will open the door to opportunities in the sciences for many more nontraditional students, who make up a large part of student bodies at community colleges, such as people of color, older students, parents, veterans and those with low-income backgrounds.”

In Nebraska, Southeast Community College will begin a three-year ATE grant project to develop a cyber-security focus for SCC’s Computer Information Technology program. Over the three-year life of the grant, the college will receive nearly $500,000 in federal money.

Today’s wireless, hyper-connected world has increased the need for cyber security in all kinds of organizations. Employers and educators are recognizing the need for additional training to meet information security needs.

SCC’s proposal will increase the availability and quality of training in cyber security for community college students. The project also will focus on increasing the participation of females and the completion rates of both males and females in the Computer Information Technology program at SCC.

Curricula for the program will be designed to meet Center for the Academic Excellence Two-Year standards for cyber security, a designation achieved by only 24 community colleges in the country. Currently, only one other Nebraska community college offers a significant cyber security focus, and the closest CAE2Y community college is more than 125 miles away.

Miami Dade College has long been a leader in enabling its students to conduct meaningful scientific research. The college’s Computing Research Lab has become a research incubator where students are encouraged to bring cutting-edge ideas to life. MDC students already have produced a mobile phone app that helps detect skin cancer at the click of a button and a prototype of a fully automated drawbridge system that doesn’t require a human operator.
Robert E. Glazebrook III is an engineering student who together with a fellow student developed the drawbridge prototype. It was the final project for his Programmable Logic Controllers course.

“My partner, Sergio Padilla and I are the type of students that take things to the next level,” he wrote in an email. “So we decided to fully automate the process. We understood that such a system could save the country hundreds of thousands of dollars each year if implemented and our system could be retrofitted to any drawbridge without major customization to the existing structure. We wrote the software program to read our sensors and lift the bridge when it’s both safe and necessary.”

MDC students have also developed prototypes for using a smartphone as a hearing aid. Another project in the works is a real-time, solar powered traffic monitoring system that has caught the attention of the Miami-Dade Expressway Authority (MDX) for future use.

Miguel Alonso, chair of MDC’s School of Engineering and Technology, started the research lab in 2010 with an NSF grant. He said the lab is intended to help recruit and retain students of Hispanic and Caribbean descent in engineering and computing careers.

“What we are trying to do is level the playing field to make sure the engineering and information technology fields have equal representation of all people,” Alonso said. “It’s important to shape students into well-rounded scholars, who can defend their ideas and theories. I never say no to an idea, and I hold them to a very high standard.”

The grant funds lab equipment and six student research stipends each semester.

Located at MDC’s Kendall Campus, the lab has become a place where students can consider ideas and engage in peer-led learning groups. Students have presented their projects and won awards at STEM competitions and conferences around the country. Whether in the research lab or class, engineering students are challenged to be disciplined, self-motivated and innovative.

“Those extend to a lot of areas other than STEM,” Alonso said. “We are really discipline agnostic. The lab experience can help students in a lot of different disciplines.”

“You can really see the transition in students,” Alonso said. “Some walk in here knowing nothing about computing or research and walk out two or three years later with a college degree.”

**IT’S YOUR TURN:** CCW wants to hear from you!

Q: Are students on your campus conducting NSF-funded research?

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