

BC3 preps students for huge opportunity in smallest of worlds

All-time high of 4 accepted into PSU nanofabrication technology capstone semester

May 10, 2017

(Butler, PA) Butler County Community College sophomore Ross Black has his sights set on that which the naked eye can't see, matter 100,000 times thinner than the width of a human hair.

Then and only then will he be able to learn to manipulate atoms and molecules in preparation for a career in nanotechnology – be it in the health, energy, medicine, agricultural or technology sectors.

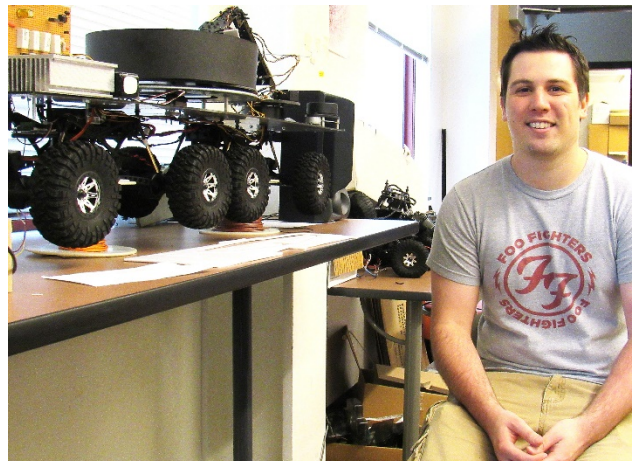
Black is among an all-time high of four BC3 students accepted this spring to the 17-year-old Pennsylvania Nanofabrication Manufacturing Technology Partnership's capstone semester at Penn State's University Park campus. Students who are accepted to the 18-credit program and earn at least a C grade in its six courses receive a certificate from Penn State's College of Engineering. In addition, for students also enrolled in BC3's Nanofabrication Technology program, the 18-credit program at Penn State must be completed in order to earn their associate degree.

That four BC3 students have been accepted to the capstone semester speaks highly of BC3 and its science and technology students, says Matt Kovac, dean of BC3's Science, Technology, Engineering and Mathematics division.

"Penn State, by and large, has had very good experiences with our students," Kovac says. "We have credibility with them. Our students are well-prepared. They go there and succeed."

Starting salaries could reach \$55K

The capstone semester will be held from May 15 to Aug. 4, according to Susan Barger, operations manager of Penn State's Center for Nanotechnology Education and Utilization.



Ross Black, 26, of Butler, a student majoring in robotics technology and nanofabrication technology at BC3, is shown on main campus on Thursday, April 13. Black will attend the Pennsylvania Nanofabrication Manufacturing Technology Partnership's capstone semester at Penn State's University Park campus this summer.

Students will learn about giving antibacterial properties to cell phones, creating more efficient solar panels, making sunscreen and cosmetics more effective, ensuring that food stays fresher longer, and making smaller and faster electronic devices, according to Penn State. Entry-level salaries in nanotechnology could reach \$55,000.

“I hope to develop skills in working with things on the nano level so I can get a job working in the field,” says Black, 26, a Butler resident majoring in both robotics technology and nanofabrication technology at BC3.

The Nanofabrication Manufacturing Technology Partnership is a joint effort between Penn State and 26 of the state’s colleges and universities. Its mission is to educate students in nanotechnology-based manufacturing and new-product development for a field that needed 1 million microelectronic fabrication technologists, research assistants, materials research technicians and semiconductor fabrication technicians as of 2015, according to a National Science Foundation estimate.

“To meet worldwide competition, the U.S. must ensure that this need for a nanotechnology work force is effectively met with high quality education,” according to Barger.

Nanotech grad credits preparation from BC3

Ben Wilson is among the 23 BC3 science and technology students who have received that high quality education at BC3 and through the capstone semester.

The 32-year-old, a 2006 BC3 graduate with an associate of applied science degree in metrology with precision measurement technology, is a manufacturing supervisor at a Reading company that makes fiber optic components for computers and cellphones.

“The Penn State program was basically the equivalent of getting an entire second associate degree,” Wilson said.

His BC3 physics and chemistry courses were important because students in the capstone semester need a solid understanding of those fields to be able to comprehend nanotechnology, Wilson said.

“If you don’t have that understanding, then you are going to be completely lost when you get to the nano program,” Wilson said, adding that vacuum technology, covered in his BC3 physics course, “is major when you get into nanotechnology.”



Ben Wilson, 32, of Reading, earned an associate of applied science degree in metrology with precision measurement technology from BC3 in 2006. He then attended the Pennsylvania Nanofabrication Manufacturing Technology Partnership’s capstone semester at Penn State’s University Park campus.

If he were to have looked for a job in nanotechnology without attending the capstone semester, “I would have been completely lost,” Wilson said. “With no understanding of it whatsoever. But having that program, it allowed me to go to a job in that field, not only where I had the potential to make more money, but I had a better understanding of the nanotechnology that we were doing at work than most of the people who had been working there for years.”

“How much smaller can we go?”

Anthony Armen, 19, of Cranberry Township, has been “curious” about the creation of microcompressors since ninth grade and attended the capstone semester in 2016, after his freshman year at BC3.

“My biggest curiosity regarding nanofabrication is wondering how much smaller can we go and how can we use this incredibly small size to our advantage?” says Armen, a BC3 sophomore majoring in engineering.

Robert Ehrmann, managing director of the Penn State’s Center for Nanotechnology Education and Utilization, is equally intrigued.

Consider the evolution of early portable phones, Ehrmann suggests. Those portable phones were about the size of a loaf of bread, had a huge battery with a life of two hours and could be used only for calls.

Today’s cellular phones can be as small as a baseball card, and be used for watching television shows, recording video, viewing maps, taking notes, sounding wakeup alarms, taking photographs, charging purchases, viewing calendars, recording audio, listening to music, scheduling appointments, and accessing compass directions.

Not to mention making calls – and all the result of nanofabrication manufacturing technology.

“It is absolutely mind-boggling,” Ehrmann says. “I took my father-in-law’s bag phone from like 1993, and in 2004 I took my flip-phone and made of picture of it and showed the picture of it (to a class). It was amazing, the difference between 1993 and 2004. And the functionality of that flip-phone was minimal. And then you think about where we have gone to today.” And tomorrow, Armen says.



Anthony Armen, 19, of Cranberry Township, a student majoring in engineering at BC3, is shown on BC3’s main campus on Wednesday, April 12. Armen attended the Pennsylvania Nanofabrication Manufacturing Technology Partnership’s capstone semester at Penn State’s University Park campus in 2016.

“I wonder how much longer until we reach the limit of the nanoscale,” he says, “and then how many ways can we manipulate the materials on the nanoscale to improve our electronic devices?”

Penn State director: BC3 STEM dean “awesome”

Nanotechnology, the U.S. government has said, “is likely to change the way almost everything – from vaccines to computers to automobile tires to objects not yet imaginable – is designed and made,” according to Penn State’s Center for Nanotechnology Education and Utilization.

Like the 25 to 40 students from across Pennsylvania admitted to the capstone semester, Black will take courses titled material, safety and equipment overview for nanotechnology; basic nanotechnology processes; materials in nanotechnology; patterning for nanotechnology; nanotechnology applications; and characterization, testing of nanotechnology structures and materials.

Black credits BC3’s instructors and Kovac for his academic preparedness for the program at Penn State.

“They went out of their way to make sure I had materials to study all the things on the list of topics PSU said I needed,” Black says. “Mr. Kovac went through my curriculum and found the things on the list of topics my classes wouldn’t cover.”

BC3’s Kovac, Ehrmann says, “is excellent. Matt is awesome. He has taken this to the next level. And I think that is key, having a strong advocate for the program.

“He sees the value to the students and how this opens up doors for them.”

The capstone semester, Ehrmann says, is appealing to students who seek to enter the workforce immediately upon receiving the certificate to augment their BC3 associate degree, and those who “say they want to be a research scientist,” Ehrmann says. “But they want to go to BC3 because it makes sense to go to BC3 because it is effective and efficient. They are going to study their butts off and get all A’s and get into a baccalaureate school, but (by going to BC3) they will save a ton of money by doing that. And when they add the nanotechnology program on top of that, it is going to open up even more doors.”

For Black, the single-most exciting advance in nanotechnology is “all the devices that are being built using the technology, especially in the medical field.”

One of the most important advances is in medicine, Ehrmann says, and specifically in the detection of disease.

“What is happening in nanotechnology is that most of the cures that are being discovered for cancer and designer drugs and things like that are all based on nanoscale understanding,” Ehrmann says. “We are getting a much better understanding of the mechanisms of why things

occur. I have a friend who had a rare form of cancer, and he's on the mend because they figured out gene therapy. Knock on wood, he will survive. He's my age, in his late 50s. Ten years ago, I don't know what would have happened."

BC3's 71-credit Nanofabrication Technology program provides students with a comprehensive background in microelectronics and nanofabrication technology. The associate of applied science program introduces students to electronic device and circuit behavior, basic chemistry and fabrication techniques used to create micron and submicron scale structures. Students will also learn about techniques that include electron beam epitaxy, plasma etching, reactive ion etching, metallization, thick and thin film deposition and photolithography.

Three of four BC3 students who have been accepted to the capstone semester have postponed their plans to attend Penn State due to commitments this summer.