



Helping Hands

MEDICAL STUDENTS USE 3D PRINTING TO SOLVE MEDICAL PROBLEMS.

It's natural for medical students to want to impact the lives of their patients but three Upstate students are going beyond the norm by using 3D printing to create low-cost solutions for medical problems.

It may sound like science fiction, but 3D printing has become increasingly common in medicine, from printing exact replicas of patient organs for surgeons to practice on to creating surgical instruments to

custom-made prosthetics. Upstate Medical University students Zach Visco '21, Eric Merrell '20 and Jade Marhaba '20 have tapped into the international 3D-printing movement, initially attracted by the possibility of creating low-cost prosthetic hands for patients.

Developed in the 1980s, 3D printing is the process of making a solid object one thin layer at a time, fusing those layers together to make the

whole. The technology has replaced traditional factory production lines in some industries. "I think the whole idea of 3D printing is just an interesting concept that people thought was really far out of reach just a few years ago, but has become so affordable that you could have it in your own home," says Merrell.

While a traditional ceramic or titanium prosthetic hand that includes multi-finger movement



Second-year medical student Zach Visco shows off a "prosthetic" hand made from a 3D printer at the CNY Biotech Accelerator.



or grasping can cost anywhere from \$10,000 to \$50,000, a working device can be created out of PLA plastic by a 3D printer in less than a day for as little as \$20. Merrell, Visco, and Marhaba have printed several working models and are currently working to design a prosthetic hand for a local man based on his specific needs.

“The original model we were working with was for patients that had a functioning wrist. You could close the fingers by moving the wrist,” explains Visco. “But this patient does not have a wrist so we’re developing a design that’s powered through the elbow joint, which is challenging.”

At the same time, Merrell and Marhaba are working on a design for a colostomy bag holder that will prevent the bag from constricting when worn under clothing. “The concept is to create a device that will hold the bag off to the side and allow it to expand without being fixated by anything that’s passing over it – such as clothing or a seat-belt,” says Merrell.

The student collaboration had humble beginnings. Marhaba says he and Merrell were “procrastinating in the library” last year when Merrell stumbled on the website for E-Nable, a nonprofit that provides plans for volunteers to make simple prosthetic hands for people who need them using 3D printing. They were intrigued.

Merrell invested in a “hobbyist” 3D printer, downloaded a plan for a hand, and printed it, which he took to an Onondaga County Medical Society Innovation Committee

meeting. Visco, who had majored in biomedical engineering as an undergraduate at Duke University, was at that meeting. “It was kind of a chance encounter but we started talking and were curious to see where we could take this,” he says.

Initially, the students considered starting a chapter of E-Nable in Syracuse, but ultimately decided to focus on problems that didn’t have pre-existing solutions. “What we’re really interested in is finding our own solution for problems that people have and making our own devices,” says Merrell. They began networking to find a Central New Yorker in need, and after doing a segment on a local news show, were contacted by the individual they are now working with to develop a 3D-printed hand for.

“We’ve taken measurements and now we’re coming up with designs based on function and what’s important for him to be able to do with it,” says Marhaba. “We could come up with designs with specific functions, like a hook that can hook on to a bike. At this point we’re contemplating making more than one model of hand for him for different uses.”

The students have received support from Robert Corona, DO, Upstate vice president of hospital administration and former vice president for innovation and business development, and Kathi Durdon, director of operations and innovation partnerships at the CNY Biotech Accelerator. “They’ve offered mentorship and access to work space and materials, as well as their 3D printer, which is much more sophisticated than what we’d been using and takes a lot of the troubleshooting out of the equation,” says Visco.

“The whole Upstate leadership has been great about publicizing our effort and getting us access to the resources to help us succeed.”

All three students are attracted by the technology and innovation the projects entail, although they are limited by the time constraints of medical school. Visco, a second-year student, is currently studying for his Step 1 board exam. Merrell and Marhaba are third-year students, now in Binghamton doing clinical rotations.

“Medicine can be slow to adapt to newer advancements in technology. I feel like the way to advance the field of medicine is to keep up with these technological advances,” says Marhaba. He concedes that the project has provided an illuminating lesson on why that isn’t always the case.

“We found out there are a lot of liability issues we weren’t aware of,” he explains. “For instance, we can’t call our device a prosthetic. And patients need to be warned that they haven’t been tested and that injury could occur.”

While the ultimate goal is in providing devices that improve individuals’ daily lives, Visco says the process is a lot of fun.

“I really enjoy the real-time aspect of it, when you send something to the printer and you start watching it print,” he says. “Basically, you get to see your results show up right in front of your eyes.”