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Made in Tompkins: Ithaca firm aims to print replacement body parts

by Olivia M. Hall, Correspondent

Lawrence Bonassar, associate professor of biomedical engineering, and colleagues collaborated with Weill Cornell Medical College physicians to create an artificial ear using 3-D printing and injectable molds. / Lindsay France / Cornell University photo

An Ithaca startup company is developing a new generation of 3-D printers that are being studied for producing replacement body parts.

The technology is being developed by Seraph Robotics, a Cornell University spinoff. The firm's current line of printers use syringe-like cartridges, filaments or a combination of both to deposit different pastes and fluids layer by layer in a three-dimensional pattern prescribed by a model, creating tangible, usable — and sometimes edible — objects.

"The technical term for the process is 'additive manufacturing,'" said Adam Tow, the firm's chief executive office. "I prefer that terminology, because if you say '3-D printing,' people often envision some sort of hologram, which couldn't be farther from the truth."

The was founded in 2011 by Tow and Jeffrey Lipton, the chief technical officer, who were both graduate students at Cornell. Tow has earned his MBA and Lipston is finishing up a Ph.D. in mechanical engineering. Together, they obtained a license from

the university for the printing technology that Lipton has been developing as a member of engineering professor Hod Lipson's Creative Machines Lab.

Using this printing technology, also called bioprinting, to produce replacement human body parts is a quickly emerging field in bioengineering. One such printer is in use at Cornell, where biomedical engineering Jonathan Butcher has printed living cells into artificial heart valves.

His colleague Lawrence Bonassar has been printing molds of ears and injecting them with a mix of collagen and living cartilage cells. Once the unmolded shape has been implanted, cartilage cells grow to replace the collagen scaffold, forming a more permanent ear.

While existing 3-D printers usually work with molten plastic, Seraph's version can accommodate a wide variety of materials, including gels used in bioengineering and foods straight from your kitchen. Hummus sculptures, anyone?

Tow's favorite edible experiment is cornmeal batter printed and then baked into the shape of a gangly octopus. "It definitely had that Pirates of the Caribbean monster feel to it," he said.

Such fun shapes are finding serious applications among researchers who hope to convince people to eat nutritious but not always attractive-looking food.

"The weirdest thing that has been printed, to my knowledge, has to be insect paste," Lipton said. "There's a group in England that believes that insects are the food source of the future."

Ever since 2012, when Seraph Robotics moved into the McGovern Family Center for Venture Development in the Life Sciences at Cornell, however, the company's focus has been primarily on biomedical applications.

"When we first encountered Seraph Robotics, they were proposing to do a lot of different things, including food printing, with their platform technology," said the center's director, Lou Walcer, who along with other mentors and alumni provides his expertise to the young startup. "But it's more lucrative and more rapid in order to get to market to pursue (biomedical projects)."

Several of these are quite promising, according to Walcer, including printing anatomical simulators for surgical training.

In the meantime, selling 3-D printers to academic research institutions — usually in bioengineering — is Seraph's main line of business, though its founders are hoping to expand their platform to a larger group of customers.

The price of the devices starts at less than $5,000. The devices can be customized to meet the needs of each lab, for example with the addition of an ultraviolet light source that allows researchers to activate photo-cross-linking processes to bond layers of different materials.

A 3-D printer in Weill Hall at Cornell University deposits cells encapsulated in a hydrogel that will develop into new ear tissue. The printer takes instructions from a file built from 3-D photographs of human ears taken with a scanner in Rhodes Hall. / Lindsay France / Cornell University photo