Katherine Lau: A New Hand for Hailey

Biomedical engineering student led team that built 3-D-printed prosthesis for preschooler.

BY CARL BLESCH

Katherine Lau joined an accelerated biomedical engineering program at Rutgers that enabled her to begin graduate study in her senior year.

In 2014, Katherine Lau was looking for a summer research project that would give her practical experience. Yong Dawson was looking for a normal life for her daughter.

Together, they gave 4-year-old Hailey Dawson a gift that doctors could not provide—an affordable, functioning prosthetic hand that can be rebuilt as Hailey grows up.

Hailey, an energetic and inquisitive little girl, was born with Poland syndrome, a birth defect marked by incomplete development of hand and chest muscles—typically on a person's right side.

When her mother sought a prosthetic device that would give her daughter functioning fingers, health professionals told her it would cost tens of thousands of dollars—just for the first prosthesis. As Hailey grew, Dawson would have to incur that expense repeatedly as Hailey needed to be refitted with larger hands.

Before the Las Vegas mother pursued that path, she turned to the local university to see if someone there might be able to help.

Brendan O'Toole, a mechanical engineering professor at the University of Nevada, Las Vegas (UNLV), saw Hailey's need as an engineering challenge—a chance for talented students to gain skills and experience while doing good.

Back in New Jersey, Rutgers biomedical engineering student Katherine Lau was looking for a research project when she moved home to Las Vegas during the summer. Networking among local health care professionals connected Lau to O'Toole.

Upon meeting Lau, then a rising third-year School of Engineering student, the UNLV professor saw that she had the educational background and leadership skills to tackle the challenge. He selected her to head up a team of

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three students to fashion a custom-fitted prosthetic hand using 3-D printing.

For Lau, it was more than a summer project. It was a life-changing experience that confirmed she had chosen the right profession.

"I want to be a biomedical engineer to improve the lives of others," says Lau. "That summer, I got to see firsthand what my work could do."

Lau's engineering team knew of public domain designs for 3-D-printed hands, such as Robohand and Enable, but its challenge was to adapt these designs to fit the young girl's size and accommodate the specific nature of her deformity. Working with Hailey throughout the summer, they fashioned a hand with fingers that grasped objects when Hailey bent her wrist forward.

"Hailey was so confident," Lau says. "Even though she has these deformities, she didn't think twice about it. She just said, 'this is my special hand,' and she showed it off to everyone." In 2015, Hailey was invited to throw out the first pitch at a Baltimore Orioles game using her 3-D-printed hand.

Lau's life-altering experience was made possible by a research stipend from Rutgers' Douglass Residential College through a longstanding program to support women pursuing degrees and careers in science, technology, engineering, and mathematics.

Lau was drawn to science and math throughout her school years, so she knew a career in engineering or medicine might suit her.

"While I was in high school, I was watching an *Oprah* episode where Dr. Oz was talking about stem cell treatment," she says. "He showed how an organ had been regrown from stem cells, and I said, 'That's what I want to do.'"

Initially, Lau planned to attend college close to home, but after her cousin from Hawaii, who was doing postdoctoral work in pharmacy at Rutgers, introduced her to the school, Lau began investigating programs in other parts of the country.

Though many schools accepted her, Rutgers "had the best engineering program for what I wanted to study," she says.

When she arrived at Rutgers University–New Brunswick in 2012, Lau was among the first 20 women in the new Douglass Engineering Living-Learning Community on the university's Busch Campus–mere steps from her classes and labs.

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Lau, right, works with UNLV student Zack Cook to fit Hailey Dawson with a 3-D-printed prosthetic hand. Joining them is Hailey's mother, Yong Dawson.

Women make up 40 percent of the biomedical engineering majors nationwide—a percentage twice as high as their representation in other engineering majors. Nevertheless, some women change majors as undergraduates or leave engineering altogether to pursue other fields, like physical therapy and medicine, after earning their degrees.

The total number of graduates in biomedical engineering is still low at 5,119, compared to more than 99,000 in engineering overall. So there are many opportunities for women in this growing major.

Although Lau's assignment in Las Vegas lasted for only a summer, UNLV Professor O'Toole remained involved with the project, tasking his students to improve on Lau's design for their senior design projects. Lau returned to New Brunswick to ponder her future.

"My major has so many options that I was trying to figure out what I wanted to do," she recalls, mulling over careers in medicine, engineering research, or teaching. Toward the end of her junior year, she applied for an accelerated master's degree program in the School of Engineering. She finished her undergraduate courses in 2016 and is on track to earn her master's degree in biomedical engineering in 2017. After that, she plans to pursue research and development positions in the biotechnology industry.