Bionic leg makes amputee faster on his feet

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Craig Hutto considers himself part bionic man. In 2005, doctors amputated his leg after a shark attacked him during a fishing trip off the Florida Gulf Coast.

"I was 16 years old at the time," recalls Hutto. "My brother heard me yell: 'What was that?' He saw something take me under; he saw the back fin of the shark. There was so much tissue damage and so much flesh gone that it was just irreparable."

Two years later and game for a challenge, Hutto became the test pilot for a unique and powerful new prosthetic leg being developed by mechanical engineer Michael Goldfarb and his team at Vanderbilt University. The effort was kick-started by a grant from the National Science Foundation (NSF).

"We were able to develop an early prototype that demonstrated that you could have a leg that was light enough and could deliver biomechanical levels of torque and power," says Goldfarb.

Version 1.0 evolved into a more streamlined version 2.0, which is computer controlled, with advanced range of motion in the joints. Version 2.0 was funded by the National Institute of Biomedical Imaging and Bioengineering at the National Institutes of Health.

"This is a battery that powers everything," explains Goldfarb, holding up the latest version and pointing to the various components. "You have a motor that drives the knee joint, another motor that drives the ankle

joint. There is a whole computer board that essentially tells the motors what to do with the joints."

In Goldfarb's lab, Hutto straps on the prosthetic and "walks the walk" on a treadmill--each step recorded by an array of cameras to help engineers improve the mechanics, electronics and software.

Brian Lawson, a mechanical engineer and member of Goldfarb's team, says what makes this prosthetic stand out is the on-board computer. "What I think makes people think that it's bionic is the computing capability that infers what the user is trying to do and works synergistically with the user to provide the torque at the right time."

The prosthetic leg is designed to respond to cues from the wearer. For example, when Hutto goes from walking to climbing stairs, he gives a signal and the bionic leg responds. "I kind of kick my thigh back just a little bit," says Hutto, "and just that little movement tells it, 'Hey you're about to walk upstairs,' and it switches mode into the stair ascent."

To reduce the risk of injury, Goldfarb's team has intentionally programmed a slight delay into the leg's computer to make sure the wearer and the prosthetic stay in perfect step with each other, and to make walking easier. "The leg can move with you," says Goldfarb.

Hutto confirms it takes less effort to walk compared to the prosthetic he currently wears. "With my leg, it's harder because it's always a step behind. I'm having to use my hip to swing my leg through, whereas the Vanderbilt Powered Prosthetic, when it toes off, the power swings the leg through and so I'm not having to use my hip to swing it through."

Goldfarb says after years of work, they have sold their technology to a major prosthetic manufacturer. "We'll know in the next few years if these are going to come onto the market and really gain a lot of traction,"

he says.

Meanwhile, Hutto, inspired by the three nurses who saved him from bleeding to death, is studying to become a nurse and looking forward to one day walking tall on the bionic leg that he helped make a reality.

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