

# Implant developer has visions of restoring sight for some

Technology targets damage to photoreceptors in eye

BY MALIA SPENCER

**W**hen you first talk to Shawn Kelly about his research, he just might pull an eyeball out of his pocket.

It's a bionic, plastic model outfitted with the technology he has spent the past 15 years developing, first at Massachusetts Institute of Technology and now at Carnegie Mellon University.

Kelly, who is joining the research faculty at CMU with a joint appointment to the Veterans Administration, is part of a team developing a retinal implant designed to help certain blind people regain their sight. He is working with 20 researchers across various universities, including Harvard, MIT and Cornell, to develop the system and form a company called Bionic Eye Technologies.

The implant is targeted at patients blinded from age-related macular degeneration or the genetic disease retinitis pigmentosa. A key element of both of these diseases is damage to the photoreceptors in the eye — for those who remember junior high biology, it's the rods and cones — rather than the nerves.

## HOW IT WORKS

The patient wears special glasses outfitted with a tiny video camera to collect images. These images are sent to a small device that processes the image and sends the information wirelessly to the implant.

Using an electrode array placed underneath the retina in the back of the eye, the implant sends an electrical current through the array that then stimulates the optic nerve, which sends the information to the brain.

The technology has been tested with a proof of concept prototype that Kelly helped build as part of his master's work at MIT.

The team has dramatic video of doctors placing the implant in a blind patient's eye and then flipping the switch. The implants were left in for a brief period and the patients, who are conscious throughout the procedure, answer the simple question: What do you see?

One woman described seeing what she called cloud structures in her field of vision.

**'If there** is something that can be done to get back their vision, these patients will be ecstatic.'

Dr. William Christie, The Surgery Center at Cranberry

"She could definitely see spots and lines that correlated with the stimulation," Kelly said.

Though not complex sight, it was a pretty big step, Kelly said, and, given more time, the brain could learn how to interpret the signal.

According to the Macular Degeneration Association, age-related macular degeneration affects 9.1 million Americans, and,

as the population ages, that number is expected to go up. As for retinitis pigmentosa, that disease is more rare, affecting 1 in 4,000 Americans, according to National Institutes of Health.

At The Surgery Center at Cranberry, Dr. William Christie sees patients daily that are blinded by macular degeneration.

"If there is something that can be done to get back their vision, these patients will be ecstatic," he said.

## THE CHALLENGES AHEAD

Still, after years of development, the technology has some major challenges, specifically when it comes to boosting the number of electrodes in the array, from the current prototype of 16 electrodes to 256, Kelly said.

Similar to a digital camera, the idea is more electrode channels means more pixels and a better image. In addition to trying to up the number of electrodes, the team is working on making a better chip case.

Kelly and Bionic Eye are not the only team developing a retinal implant. A California firm called Second Sight began selling an implant system in Europe earlier this year, but, Kelly noted, that company is

also trying to figuring out a way to boost the number of electrodes.

Despite the technical challenges ahead, Kelly sees fundraising as a bigger hurdle, "especially for a project that is longer term and not a three-year return," he said. It will take a special sort of investor.

## PLANS FOR THE FUTURE

To date, the work has been funded by

federal research grants and foundations to the tune of \$35 million. But, now, Kelly is shifting to commercialization and seeking investors.

He said he's looking to initially raise about \$7 million. Bionic Eye is seeking a class three medical device clearance and hopes to be in human trials in two to three years.

It was visions of "The Six Million Dollar Man" that initially intrigued James Jordan, vice president and chief investment officer of the Pittsburgh Life Sciences Greenhouse, when Kelly called.

"You have to have a meeting when you have a product called Bionic Eye," Jordan joked, and when that happened, he was impressed by the Bionic Eye team and the research.

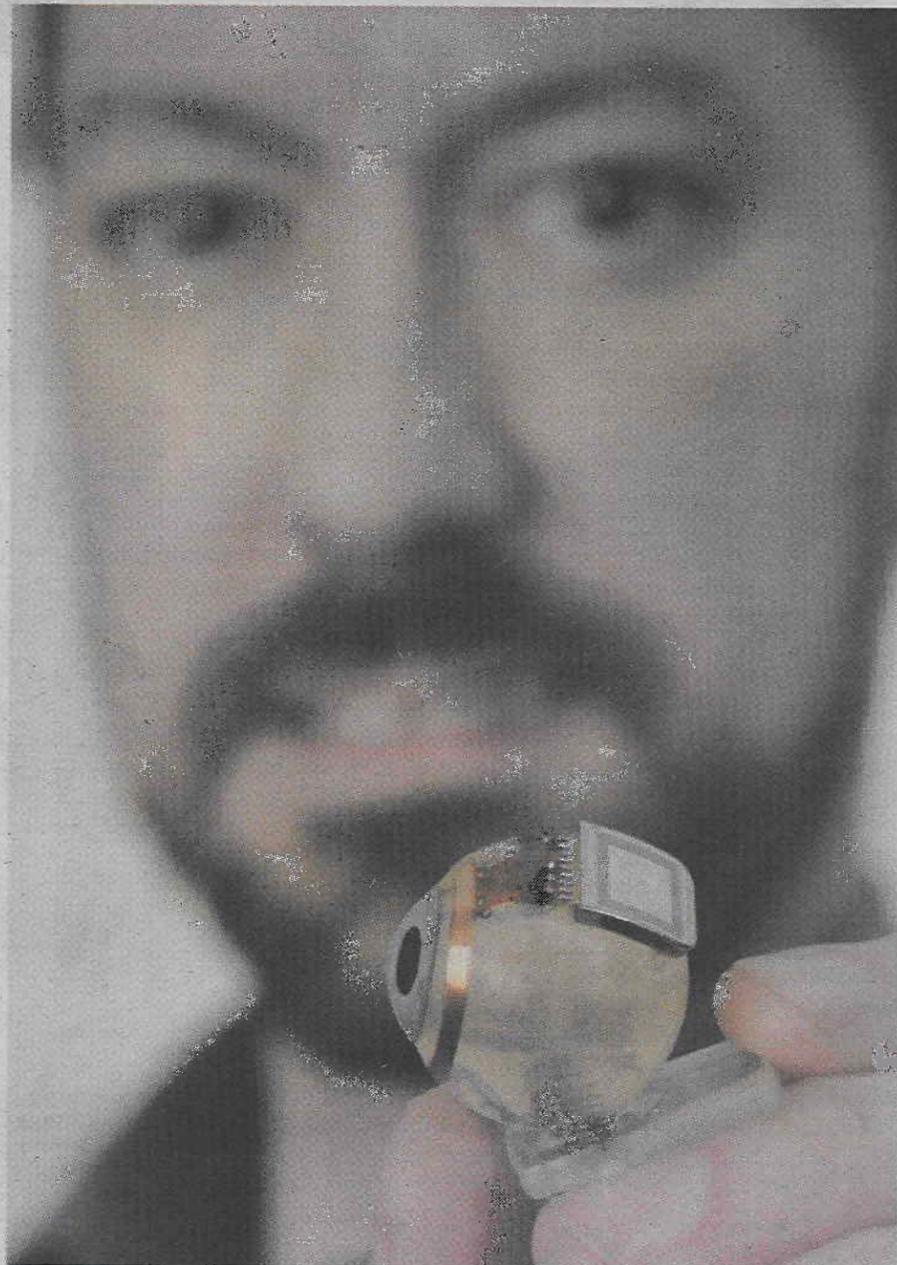
The company just needs to hammer out a commercialization plan.

As for the competition, James said, just because there are other players in the market doesn't mean that Bionic Eye won't be successful.

"If you enter new markets and need to get the FDA and regulators to understand the product and reimbursement codes, this company that has gone before them is bearing a lot of those costs," Jordan said.



An occasional series on cutting-edge technology developed in Pittsburgh



Shawn Kelly, cofounder and vice president of engineering for Bionic Eye Technologies, holds a model eye with the company's retinal implant attached.



Glasses with a camera, image processor and telemetry system from Bionic Eye.