Medical Xpress

Researchers discover way to improve image sharpness for blind people with retinal implants

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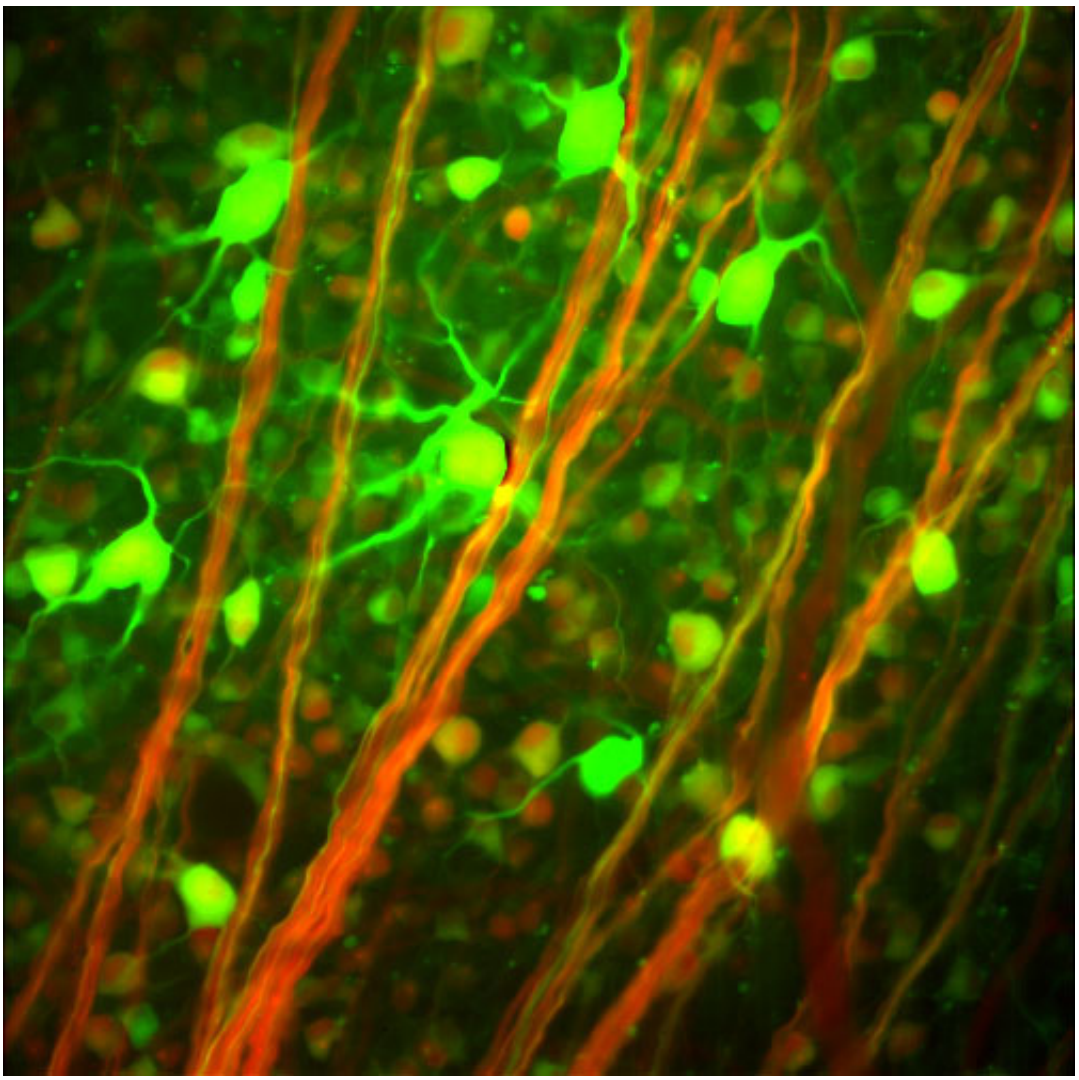

A special fluorescent imaging technique was used to visualize the patterns of cells in rat retina that were activated by electrical stimulation. The shapes of

these patterns resemble the shapes of light seen by retinal implant patients. Credit: University of Southern California

Retinal implants that deliver longer pulses of electrical current may noticeably improve image sharpness for individuals who have lost their sight due to retinitis pigmentosa, according to a new study by researchers from the USC Eye Institute and USC Viterbi School of Engineering.

The research will be published in the peer-reviewed journal *Science Translational Medicine* online on Dec. 16, 2015.

Retinitis pigmentosa (RP) is an inherited disease of the eye that causes blindness through gradual degeneration of photoreceptors, the light-sensing cells in the retina. The disease affects about one in 4,000 people.

Retinal implants (artificial retinas) give people with RP the ability to perceive light, using a system that includes a video camera mounted on a pair of eyeglasses, a video processing unit that transforms images from the camera into wirelessly transmitted electronic signals, and an implanted array of electrodes to stimulate visual neurons.

Retinal implants have enabled blind individuals to detect motion and locate large objects. However, because the implants may unintentionally stimulate axons in the retina, patients sometimes see large oblong shapes of light that reduce the quality of their vision. In order for patients to see more clearly, the images created by the implant should be composed of focal spots of light.

Current implant technology stimulates the retina with brief pulses of electrical current roughly 0.5 millisecond (ms) in duration. The researchers found that increasing the duration of the stimulus pulses

allows visualization of distinct focal spots of light.

"This is a huge step forward in helping restore sight for people with retinitis pigmentosa," said Andrew Weitz, PhD, assistant professor of research ophthalmology. "Being able to create focused spots of light is important. Think of each light spot as a pixel in an image. By arranging many light spots into the shape of an object, we can generate sharp images of that object. For those of us who wear glasses, imagine the difference between trying to read a distant neon sign with and without your glasses on. For people with retinal implants, being able to see more clearly should have a big impact on their ability to recognize objects and navigate their environments. These improvements in vision can really boost a person's sense of independence and confidence."

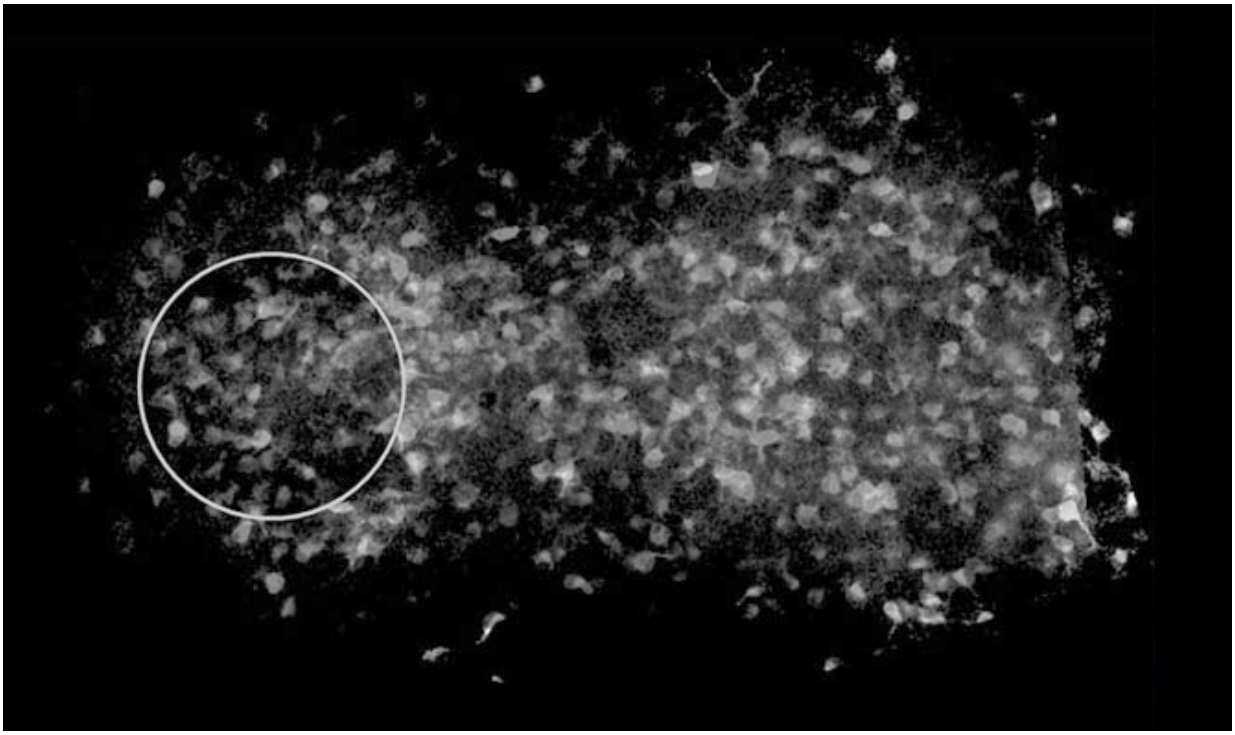

Image of cells in rat retina that were activated by electrical stimulation. The electrode (white outline) delivered pulses of electrical current identical to the

types of pulses used by existing retinal implants. The stimulus activated a streak-shaped pattern of cells, resembling the large streaks of light seen by implant patients. These streaks limit the quality of patients' vision. Credit: University of Southern California

The researchers tested various stimulus pulse durations in an animal model and validated their findings in a patient with an early version of the Argus retinal implant (Second Sight Medical Products, Inc.). The results indicated that longer pulse durations allowed the retina to be stimulated more precisely. In the animal model, all pulses 8 ms and shorter activated axons, obscuring the ability to generate a focal spot of light. Sixteen-millisecond pulses also stimulated axons but to a much lesser extent. Pulses 25 ms and longer produced no evidence of axonal stimulation, instead resulting in focal spots of light.

"Our findings further support that it is possible for patients with RP to see forms using artificial vision," said James Weiland, PhD, professor of ophthalmology and biomedical engineering. "This makes a strong case for developing high-resolution retinal implants."

More information: "Improving the spatial resolution of epiretinal implants by increasing stimulus pulse duration," by A.C. Weitz et al. stm.sciencemag.org/lookup/doi/ … scitranslmed.aac4877

Provided by University of Southern California