Deep brain implants show bionic vision promise

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Implants buried deep inside the brain may provide the best hope yet for vision-restoring bionic eyes.

Most visual prosthetics rely on implants behind the retina. These stimulate surrounding nerve tissue to generate points of light, called phosphenes, in the mind's eye. Such prosthetics require a detailed map of where phosphenes appear in response to electrical stimulation. Once this map is complete, digital images, captured by a camera, can be converted to electrical pulses that produce multiple points of light, allowing a blind person to "see" simple shapes.

In patients with severe eye trauma, however, there may not be enough surviving retinal neurons to stimulate. Or a patient's retinas may simply have degenerated over time.

An alternative is to place implants directly in the brain, within the visual cortex. But this is a large and complexly folded part of the brain, making access and mapping of the visual field a serious challenge.

Brain access

Now John Pezaris and colleague R. Clay Reid, both at Harvard Medical School in Boston, US, have shown that phosphenes can be produced by stimulating the lateral geniculate nucleus (LGN) – an area deep in the centre of the brain that relays visual signals from the retina to the cortex.

The LGN was previously thought to be too difficult to reach. But surgical advances for deep brain stimulation – including treatment used for movement disorders such as Parkinson's disease – have made accessing it relatively easy, via a single small hole in the skull.

Pezaris and Reid tested LGN electrode implants on two adult macaques. Each animal had previously been trained to quickly direct their gaze towards a point of light on a computer screen. They then ran three types of trials: one in which a flash appeared on the screen; another in which the monkey received an electrical pulse from their implant; a third in which nothing happened at all.

With electrical stimulation, the monkeys directed their gaze at specific points in front of them, exactly as if they had just "seen" a flash. When the researchers implanted two separate electrodes, stimulating different parts of the LGN, the monkeys looked in two different directions, one after another.

General vision

"This research establishes that there is a new avenue for further exploration," says Pezaris. "What we created was only two points of light, two pixels. Though the exact numbers haven't been determined accurately, it's generally thought that we need some hundreds of them for general vision."

In the coming months, the team will repeat the experiment with eight electrodes, and ultimately plan to apply the technique to humans.

Peter Schiller at MIT, who works with implants in the visual cortex, says only further research will reveal what area is best suited for implants. "The geniculate is more promising than the retina, but I am not at all convinced that is it better than the primary visual cortex," he says.

"Given the limitations of how tightly packed you can put in an [electrode] array, and how much the current spreads at the tip of the electrodes, it is highly desirable to place them in an area with the largest amount of visual tissue available," he told **New Scientist**.

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