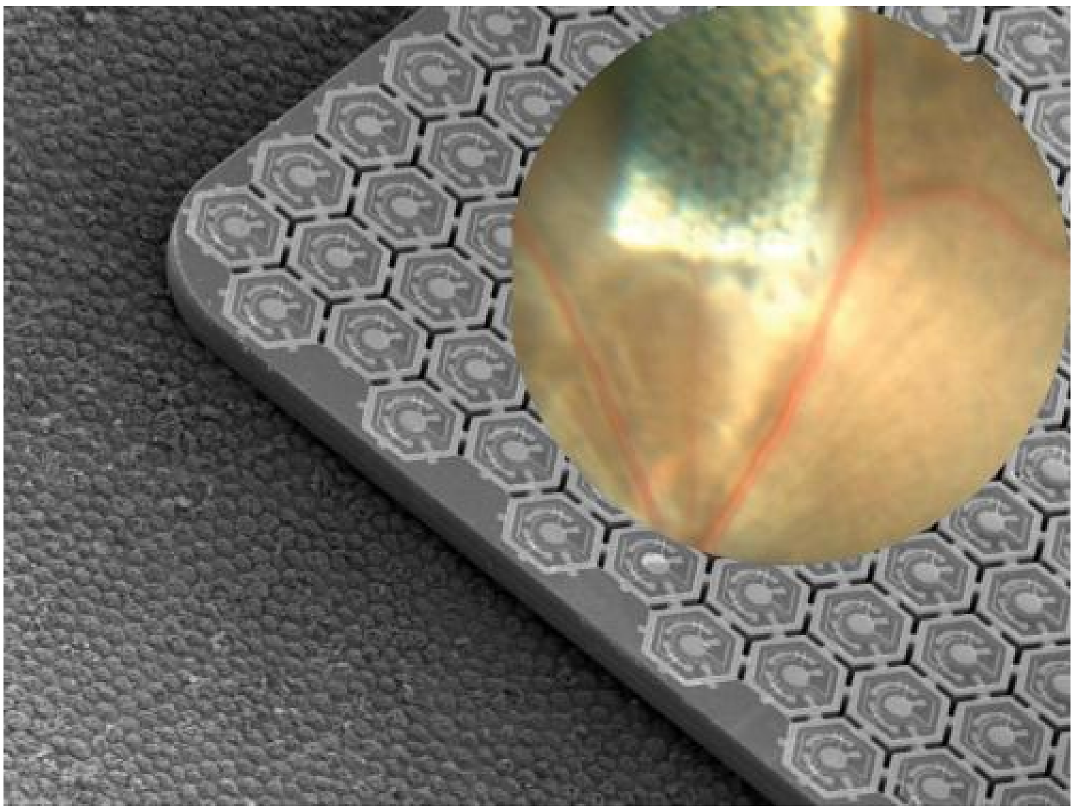
Wireless subretinal prostheses allows blind mice to see light

June 19 2013, by Bob Yirka



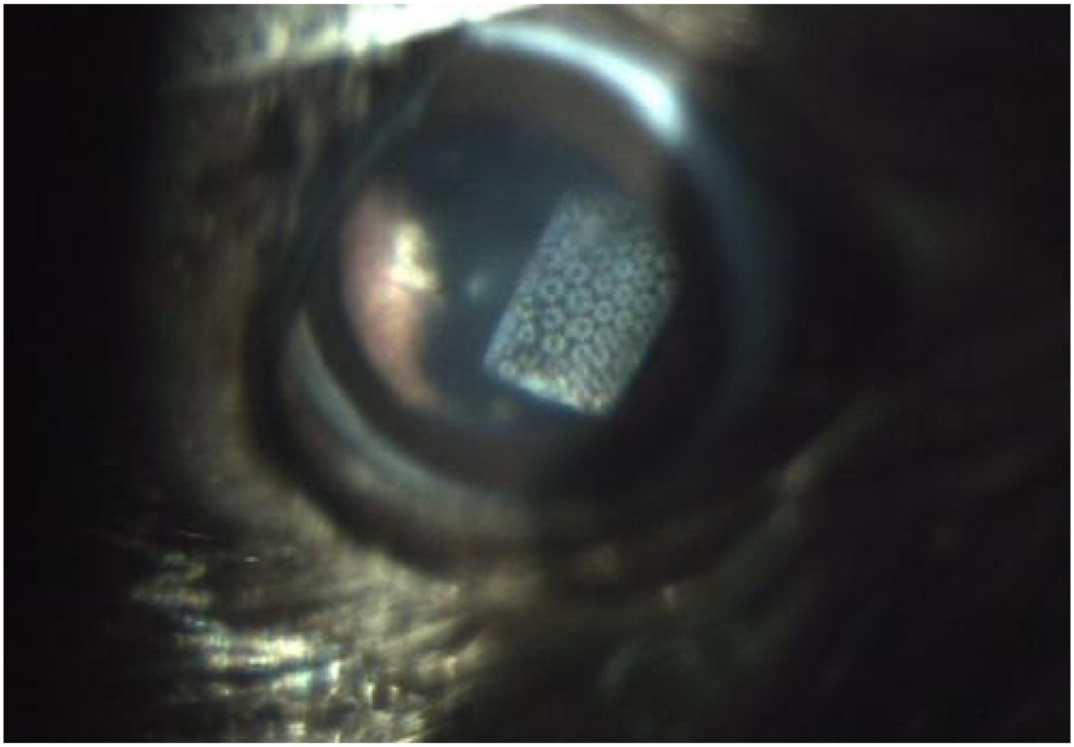
Photovoltaic array with 70 µm pixels placed on top of the retinal pigmented epithelium in the eye. Color insert: fundus photo of a rat eye with subretinally implanted photovoltaic array with 140 µm pixels. Credit:Palanker Lab, Stanford University, CA

(Medical Xpress)—A team of researchers from the U.S. and Scotland has developed a new type of retinal prostheses designed to restore sight to blind patients. In their paper published in the journal *Nature Communications*, the team describes how they developed a device that can be placed below the surface of the retina to send signals directly to neurons behind damaged photoreceptor cells.

Artificial retinal implants have been in the news a lot lately—as minituration of microelectronics has improved, so too have the devices that have been developed to help restore vision to people who lose their site due to damage to the retina. Diseases such as retinitis pigmentosa in young patients and macular degeneration in those that are older cause damage to the photoreceptors that convert light to signals the neurons beneath them can understand. In this new effort, instead of placing a device over the top of the retina, the researchers placed it under the damaged photoreceptors of test mice and connected it directly to the neurons that lay underneath, providing a direct connection to the brain.

To make use of the implant, goggles are placed on the face with a camera set in the nosepiece. Data from the camera is sent to a tiny computer that in turn sends a signal to a wireless infrared laser device also mounted on the goggles. The laser shines constantly on the retinal implant (through the photoreceptor layer) which responds by sending electrical signals directly to the brain via neurons. The entire system is wireless, making it easier to use than other implant systems. The implant itself is also smaller than that used in other devices—approximately half as thick as a human hair—which the researchers say, makes it less susceptible to complications. It's also scalable, meaning that as technology improves more pixels can be added to fine tune the image that is sent to the brain.

Medical Xpress



Photovoltaic array with 140 µm pixels implanted under the retina in a rat eye. Credit: Palanker Lab, Stanford University, CA

To test their system, the researchers monitored brain activity while the implant system was operating. They report that exposure to light caused activity in the visual cortex very similar to what occurs in the brains of mice with undamaged retinas. This they say indicates that the mice are able to see some amount of light, though it's still unclear if they are able to make out patterns.

More information: Cortical responses elicited by photovoltaic subretinal prostheses exhibit similarities to visually evoked potentials, *Nature Communications* 4, Article number: 1980
doi:10.1038/ncomms2980

Abstract

We have previously developed a wireless photovoltaic retinal prosthesis, in which camera-captured images are projected onto the retina using pulsed near-IR light. Each pixel in the subretinal implant directly converts pulsed light into local electric current to stimulate the nearby inner retinal neurons. Here we report that implants having pixel sizes of 280, 140 and 70 μm implanted in the subretinal space in rats with normal and degenerate retina elicit robust cortical responses upon stimulation with pulsed near-IR light. Implant-induced eVEP has shorter latency than visible light-induced VEP, its amplitude increases with peak irradiance and pulse duration, and decreases with frequency in the range of 2–20 Hz, similar to the visible light response. Modular design of the arrays allows scalability to a large number of pixels, and combined with the ease of implantation, offers a promising approach to restoration of sight in patients blinded by retinal degenerative diseases.