USC Research May Help Patients Blinded by Retinitis Pigmentosa

Over 25 million people around the world, including 6 million in the United States, have been visually affected by genetic retinal diseases. By 2020, that number is expected to double. But patients who have lost their sight due to genetic eye diseases that affect the retina may be one step closer to one day regaining some of their sight.

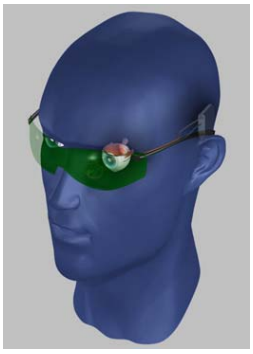
When patients inherit retinal diseases, they lose the ability to capture and process the light that passes through the eye. As these cells degenerate, patients experience vision loss because they can no longer process light through their photoreceptors. Researchers at the Doheny Eye Institute at the University of Southern California (USC) have developed a new prosthetic implant, called the Argus II, that can better mimic photoreceptor cells in the retina. The new implant, like its forerunner the Argus I, was developed by Dr. Mark Humayun's research team at USC and Second Sight Medical Products Inc, a private company based in Sylmar, CA. Dr. Humayun, a Professor of Ophthalmology and Biomedical Engineering at Keck School of Medicine of USC, is the Director of the NSF-funded Biomimetic Microelectronics Systems Engineering Research Center (BMES) at USC. BMES is developing the fundamental technology that underpins advanced neural implants like the retinal prosthesis.

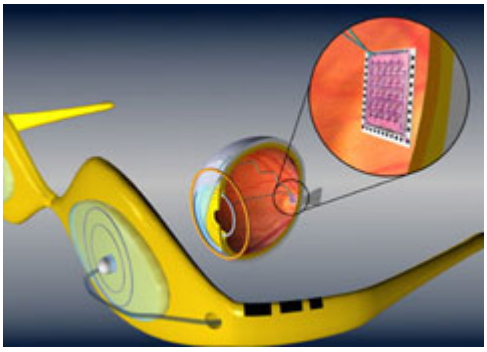
The ARGUS II consists of a tiny camera and transmitter mounted in eyeglasses, an implanted receiver, and an electrode-studded array that is secured to the retina with a microtack the width of a human hair. A wireless microprocessor and battery pack worn on the belt powers the entire device. It is notable that the microelectronic circuit that serves as the "brains" of the ARGUS II implant was first developed with NSF funding, awarded to Humayun and Dr. Wentai Liu, UC Santa Cruz, between 1998 and 2001. Building on this success, the NSF awarded the BMES in 2003.

Six patients were implanted with the ARGUS I beginning in 2002 and can now perceive light, distinguish between objects, and detect motion. The new implant contains nearly four times as many electrodes as the original (60 vs. 16), each of which is independently controllable, allowing patients to process higher-resolution images. The ARGUS II is also a quarter of the Argus I's size, minimizing surgery and recovery time. Researchers hope the ARGUS II will be commercially available in a few years and are currently enrolling subjects in clinical trials.

The retinal prostheses project at USC is supported by NSF, the Department of Energy, the National Eye Institute/NIH, Research to Prevent Blindness, the W.M. Keck Foundation, and the Albaugh Family Trust.

Mark Humayun, a Professor of Ophthalmology at USC and BMES ERC Center Director, leads the effort to develop a functioning retinal implant.





The retinal prosthesis consists of a camera and transmitter mounted in eyeglasses, an implanted receiver, and a microelectrode array attached to the retina.

Why is this research outcome notable and/or important, and how does it address the strategic outcome goal(s) as described in the NSF Strategic Plan 2006-2011?

The second-generation retinal prosthesis resulting from this research is now entering clinical trials. The research underlying this advance is highly innovative, cross-disciplinary, requires a complex systems approach, and involved close and long-running collaboration between a university and a private company.

Does this highlight represent transformative research? If so, please explain why.

Yes. The series of breakthroughs in microelectronics, image processing, and bioengineering represented by this work are likely to lead to radically new prosthetic technologies in other areas besides the retina.

Does this highlight represent Broadening Participation? If so, please explain why.

Yes. A number of key members of the research team are women.

Are there any existing or potential societal benefits, including benefits to the U.S. economy, of this research of which you are aware? If so, please describe in the space below.

By 2020, some 50 million patients who have lost their sight due to genetic eye diseases that affect the retina may be able to regain some of their sight using this retinal implant. The economic value of the technology is difficult to estimate but is very large.

ERC for Biomimetic MicroElectronic Systems (BMES) - http://bmes-erc.usc.edu