

2009 Award Winner

RESTORING SIGHT TO THE BLIND

Livermore scientists have developed the first long-term retinal prosthesis that can function for years inside the harsh biological environment of the eye. The device, called an artificial retina, uses application-specific integrated circuits for transforming digital images from a camera into electric signals in the eye that the brain can use to create a visual image.

Seeing Results

In ongoing clinical trials, human subjects using the artificial retina successfully identified the position and approximate size of objects, and detected movement of nearby objects and people. The artificial retina is the only retinal stimulator in large-scale, long-term clinical trials. The device has a fully portable external system, and the implant can withstand daily use for many years. The artificial retina with its metal-ceramic biocompatible electronics package is designed to last more than five years with daily use.

Foresight

Additional research and development will produce artificial retinas with more than 1,000 electrodes, which potentially will allow patients to recognize faces and to read. Technology used in the artificial retina could conceivably be adapted to help patients with spinal cord injuries, Parkinson's disease, deafness, and many other neurological disorders.

The same microelectronic system may also be modified to interface with other cell types such as plants and bacteria, which means it could ultimately be used for a variety of applications including environmental cleanup and countering bioterrorism.



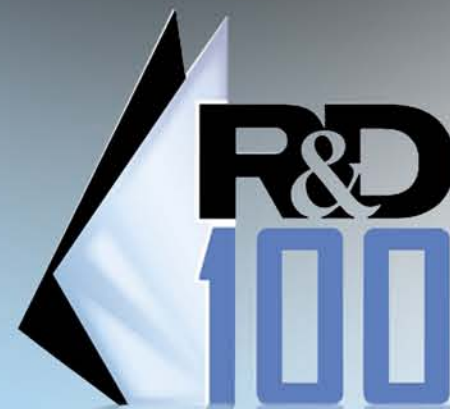
The artificial retina can function for years inside the harsh biological environment of the eye.



Members of the artificial retina development team: (first row, from left): Charlene Sanders (ORNL), Vincent Kandagor (ORNL), Adrian Casias (SNL), Gianluca Lazzi (NCSU), Wolfgang Fink (Caltech), Mark Humayun (Doheny), James Weiland (Doheny), Lindy Yow (Doheny), Dao Min Zhou (SSMP), Orlando Auciello (ANL); (second row) Dahweh Chiu (SNL), John George (LANL), Sat Pannu (LLNL), Guo Xing Wang (SSMP), Konstantin Kolev (Doheny), Dean Cole (US DOE), Kurt Wessendorf (SNL), Jim Little (SSMP), Wentai Liu (UCSC), Kuanfu Chen (UCSC), Aditi Ray (Doheny); (third row) Rongqing Dai (SSMP), Anderson Pinto (Doheny), Kris Christen (ORNL), Biju Thomas (Doheny), Atoosa Lotfi (Doheny), Lihsien Wu (UCSC), Moo Sung Chae (UCSC), John Xie (Doheny); (fourth row) Adrian Rowley (Doheny), Sean Pearson (SSMP), Nick Talbot (SSMP), Murat Okandan (SNL), Lucien Laude (Doheny).

ORNL – Oak Ridge National Laboratory
SNL – Sandia National Laboratory
NCSU – North Carolina State University
Doheny – Doheny Eye Institute
SSMP – Second Sight Medical Products, Inc.
ANL – Argonne National Laboratory

LANL – Los Alamos National Laboratory
LLNL – Lawrence Livermore National Laboratory
US DOE – U.S. Department of Energy
UCSC – University of California, Santa Cruz
CalTech – California Institute of Technology



The artificial retina development team at Livermore: (from left) Erika Fong, Emil Geiger, Satinderpall Pannu, Maxim Shusteff, Kedar Shah, Terri Delima, Julie Hamilton, and William Benett. (Not pictured: J. Courtney Davidson and Phillippe Tabada.)

