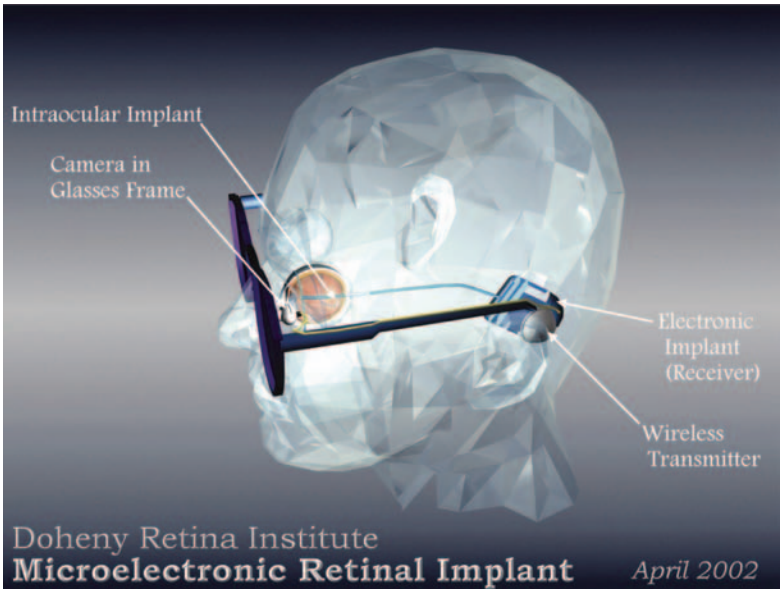
# Emerging science & technology

## Helping blind people to see

*...the digital visual image is processed and sent to the electrode array, which has been surgically placed on the retina…*

While using the device, blind patients were able to see shapes and images.




*The illustration above shows the camera within the eyeglass lens, wireless transmitter on eyeglass frame, implanted receiver, and the implant on the retina. Illustration courtesy of Doheny Eye Institute/ USC, Los Angeles, California.*

*Douglas L. Beck Au.D.*
*Director of Professional Relations*
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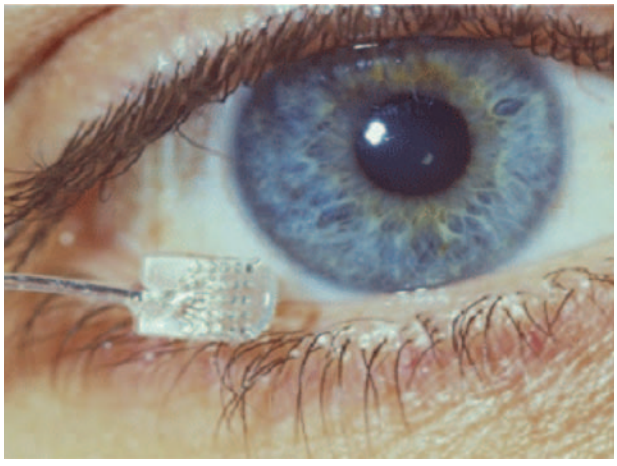
Audiologists are familiar with how cochlear implants help people with severe and profound sensorineural hearing loss (SNHL) regain the perception of speech. However, many audiologists are surprised to learn similar technologies have been applied to help blind people see.

When blindness is caused by retinal degenerative processes such as retinitis pigmentosa (RP) and macular degeneration, as is the case for more than three million people in the western world , some of these people may benefit from advanced retinal prosthetics.

Second Sight® Medical Products, Inc. (founded 1998, located in Sylmar, California, USA) pioneered the development and application of many of these technologies through their sister company, Advanced Bionics, a cochlear implant manufacturer and part of Boston Scientific Group. Significant pioneering work on this project was initiated by Dr. Mark Humayun at the University of Southern California (USC). These groups and individuals are working with government and university partners to further this work.

The visual input is gathered through sophisticated external hardware, including a miniature digital movie camera mounted within a pair of glasses. The image is processed and sent to the electrode array. The retinal prosthetic electrode array is surgically placed on the retina where neural fibers are physically contacted, stimulated, and their bioelectric signal is transmitted along the optic nerve. Future retinal electrode arrays

will be hermetically sealed and protected using an ultrananocrystalline diamond (UNCD) film, which is safe, long lasting, electrically insulating and extraordinarily tough. The diamond grains within the film are five millionths of a millimeter across.

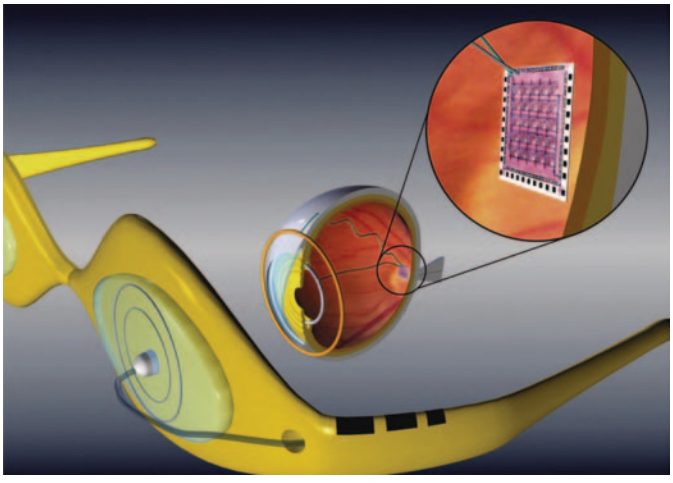


*The photograph above shows the relative size of the early 16-electrode array as compared to the human eye. Photograph courtesy of Second Sight Medical Products.*

Although the device pictured above is an early array with 16 electrodes, electrode arrays under development contain more then ten times that number. The exact "ideal number" of electrodes is not yet known, but as is true with cochlear implants, successful transmission of sensory information (auditory and/or visual) is far more complex than might be reflected by a single number quantifying the number of electrodes. Each unique patient, their particular situation and their ability contributes to their candidacy for the visual implant, and eventual outcome.

Even with the early 16-electrode array, blind subjects were able to see different shapes and images and were able to tell the difference between a cup, a plate and a spoon, and they could identify large letters.

The visual implant is still in FDA trials with six patients implanted to date. The oldest implant was implanted more than four years ago and is still being used daily by the patient. A second-generation device is planned to be tested in patients soon. These technologies provide exciting opportunities for scientific and clinical advances, and like cochlear implants, the opportunity to enhance the quality of life for many people is indeed exciting.



*The illustration above shows the location of an electrode array on the retina. Illustration courtesy of Doheny Eye Institute/USC, Los Angeles, California.*

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