Inside the bionic eye

What is the bionic eye?

The bionic eye is a retinal prosthesis designed to restore the sense of vision to people who are blind due to degenerative retinal conditions. This technology makes use of a retinal implant and a digital camera mounted on a pair of glasses. The camera captures images, processes them and sends data to the implant. The implant contains a number of electrodes, which stimulate the remaining cells of the retina to elicit the perception of vision.

How exactly does it work?

The bionic eye utilises the eyeglasses-mounted digital camera to capture the scene in front of the patient. This image is processed and then sent to the implanted electrode array, which stimulates the surviving nerve cells in the patient's retina.

Once the patient’s retina has been stimulated, electrical impulses from the retina travel along the optic nerve to the vision processing parts of the brain and are decoded into sight.

First prototype: the wide-view device

The retinal implant for the first prototype bionic eye contains an electrode array with 98 stimulating electrodes. This implant will be placed between the choroid and the sclera layers of the retina, protecting the retina from mechanical damage during insertion and helping to maintain the implant's position.

The wide-view device builds upon technologies that have been successfully employed in cochlear implants and uses materials with established biocompatibility and biostability. This device aims to restore vision to a degree that enables increased mobility and independence for patients.
Second prototype: the high-acuity device

The retinal implant for the second prototype bionic eye contains an integrated chip with an electrode array with 1000 penetrating electrodes. The implanted components are made of stable, inert materials, such as poly-crystalline doped diamond, that have been used in other implanted medical devices.

The high-acuity device aims to restore vision to a level where patients will be able to recognise faces and read large print. This second generation implant will be informed by the experience of the first prototype patient tests, accelerating the pathway of this second prototype to clinical tests.

What exactly is medical bionics?

Medical bionics is the field of science and biomedical technology at the interface of engineering, biology and medicine, which seeks to replace lost physiological functions through technical and electronic means. The word ‘bionic’ is a portmanteau word from ‘biology’ and ‘electronic.’

There are three categories of medical bionic devices: those that send signals from the brain to another part of the body (e.g. bionic hand); those that send signals from the body to the brain (e.g. bionic ear); and those whose action is restricted to one part of the body without becoming part of the nervous system (e.g. cardiac pacemaker).

The most prominent Australian example of medical bionics is the highly successful cochlear implant, or ‘bionic ear’, developed at the University of Melbourne and the Bionic Ear Institute, commercialised by Cochlear Ltd.