# Bionic eye hope blends lasers and gold

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A novel approach to restoring sight using a ‘bionic eye' is being investigated at Swinburne University of Technology.

The laser stimulation of optic nerves is the focus of this research to develop a vision prosthesis - perhaps a tiny laser device fitted in a pair of spectacles - much like the cochlear implant for restoring hearing.

Swinburne's Applied Optics and Biomedical Engineering Groups are seeking government and philanthropic funding to progress this research using gold nanoparticles to amplify laser light.

These microscopic nanoparticles, fixed to optical nerves and assembled to respond to different laser light wavelength, could become the key to

restoring vision to people who have lost their sight through degenerative eye disease.

The researchers are looking for a non-contact method of stimulating nerves and are exploring the use of laser light, rather than the direct electrical stimulation techniques that have become the conventional approach.

Using a very low intensity laser source they are trying to generate the right amount of heat required to elicit a response from nerve cells without damaging them.

According to researcher PhD student Chiara Paviolo, the new concept explores the potential for light to deliver far more precise nerve cell stimulation than electrodes.

"Electrodes need an electrical current and so they consequently stimulate a group of nerves," Paviolo said.

"Light, however, allows us to target individual nerves and this should mean more accurate communication of optical signals - an essential outcome if the information delivered to the brain via a prosthesis is to mean anything useful in terms of shapes, colours, dimensions. You don't just want optical ‘noise'."

The initial goal is to successfully bond the nanoparticles to the nerve and then achieve a response to light heat.

Gold nanoparticles are being used because gold is inert, biocompatible and has plasmonic or light-responsive properties. The gold nanoparticles can also be fabricated to respond to different wavelengths, making the interface controllable.

"One of the challenges is to develop nanoparticles that are thermally stable," said Professor of Biointerface Engineering Sally McArthur . "While on one hand heat is necessary, it also has to be limited to avoid damaging cells. Laser heat has long been used in medicine to deliberately kill tissue, but in this instance the opposite result is sought."

To measure and control the heat, the Swinburne team is building a molecular thermal sensor to measure how much heat is produced, so they can then work out how to control it.

The team's ultimate ambition for its technology is a prosthesis that in the first instance will restore vision to people who have lost their sight through retinitis pigmentosis or macular degeneration.

"With these diseases the nerve is still alive, making it a strong candidate for a prosthesis," Paviolo said.

Paviolo said international interest is already building in the Swinburne project because the concept of using light stimulation combined with nanotechnology is novel.

Provided by Swinburne University of Technology