Form-Fitting Photovoltaic Artificial Retina

Andrew Seitler, Biomedical Engineering: University of Rhode Island

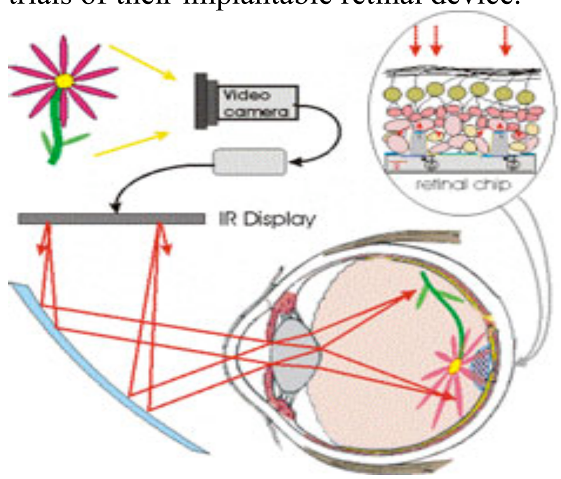
The goal of nearly all retinal research and implants is to give some or all vision back to those who have lost their vision. An immediate goal of this is to find a practical retinal prosthesis that can be implanted in the back of an eye. Immediately this requires a form of wireless power the camera source to the retinal prosthesis.

There are multiple approaches in this field to achieve the same goal. The first is the University of Southern California's Doheny Eye Institute which has been implanting the Argus II for nearly two years. Their approach wireless power approach is to use RF signals to send power and data to the retinal implant. Stanford University is doing a similar yet more obvious approach using ambient light to transmit both the power and data to the retinal implant.

Recently a discovery by the Stanford Ophthalmology department showed a migration of retinal cells. This is where a sub-retinal implant allows for the cells to regroup around the implant and preserve the connection to the retina above the implant.

Stanford's design currently uses a goggle mounted camera to view and transmit the information and power. The transmitter uses pulsed IR which the retinal implant uses photodiodes to convert the pulses of light into pulsed current from intraocular photovoltaic.

Similar research is being by the University of Southern California's Biomimetric MicroElectronic Systems Engineering Research Center which boasts a 1000-pixel test system. This new system will drastically improve the vision that will be regained by patients who have lost their vision. There is an expected five years before this product will be available for clinical trials. They are being even more progressive by pushing to have their entire unit be an implantable device. The downside is that that could drastically push off the time period where they could start clinical trials of their implantable retinal device.



The Future goals in this field are to make the entire device fully implantable. Currently the camera, image-processing hardware, power amplifier, and data modulator are external hardware. The first and most difficult part of this is making a miniaturized camera that can fit on the lens of the eye. Hopefully all of this hardware will become small enough to fit onto the lens of the eye and hopefully be invisible.

Eventually the goal is to use light that is already being filtered through the eye to power and give detail to newer and more effective implantable systems. Using carbon nanotubes, an increase in safety and a decrease in power is expected.

Resources:
http://spectrum.ieee.org/biomedical/bionics/a-formfitting-photovoltaic-artificial-retina

http://ophthalmology.stanford.edu/research/basic_retinal_prosthesis.html

http://spectrum.ieee.org/biomedical/bionics/researchers-hope-to-mime-1000-neurons-with-highres-artificial-retina