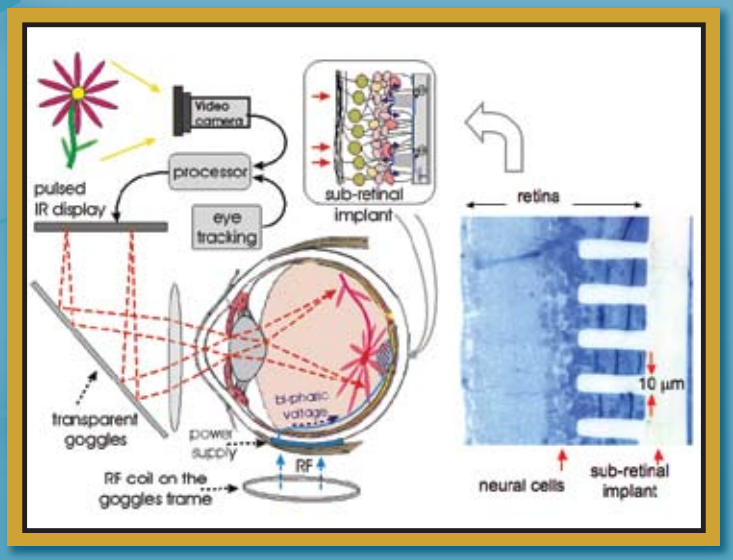
Advanced Instrumentation Seminars

February 6, 2008
1:30 pm, 1st Floor
Kavli Auditorium

High Resolution
Optoelectronic Retinal Prosthesis

Guest Speaker –
Daniel Palanker
Stanford University



Blindness is more feared by the public than any ailment except cancer and AIDS. Electronic retinal prostheses represent a potentially effective approach for restoring sight in patients who lost their vision due to retinal degeneration. Patterned visual perception in response to patterned electrical stimulation has been demonstrated in blind patients. However, design of a high-resolution prosthesis presents many engineering and biological challenges. Large number of stimulating electrodes should be placed close to the target retinal cells to prevent "blurring" and minimize current. Signals must be delivered wirelessly to thousands of electrodes, and visual information should, ideally, maintain its natural link to eye movements. Finally, a good system must have a wide range of stimulation currents, external control of image processing, and pulse polarity.

I will discuss these challenges and present solutions to them for a system based on a photodiode array implant. Video frames are processed in a portable computer and imaged onto the retinal implant by a head-mounted projection system operating at near-infrared wavelength (~900nm). Photodiodes convert light into pulsed electric current; with a charge injection maximized by applying a bi-phasic bias waveform common to all pixels. Pulsed bias is provided by the inductively-coupled RF link from the coil on the goggles into a miniature power supply implanted between the sclera and the conjuctiva, and connected to subretinal implant with a thin 2-wire trans-scleral cable. The resulting prosthesis will provide stimulation with a frame rate of up to 50 Hz in a central 10o visual field, with a full 30° field accessible via eye movements. Pixel sizes are scalable from 100 to 25 µm, corresponding to 640 - 10,000 electrodes on an implant 3 mm in diameter. Close proximity between electrodes and the target neural cells is achieved utilizing retinal migration into the 3-dimensional subretinal implant.

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