Neurosilicon

THE PHOTOCONDUCTIVE STIMULATION DEVICE (PSD)

"Non-invasive, Controlled, Depolarization of Excitable Cells"

Advancing life science research through enabling rapid, non-invasive, targeted excitation of excitable cells quickly and easily

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- Non-invasive photoconductive stimulation reduces excitotoxity supporting extended periods of analysis
- Optical targeting allows excitation targeting from single cells to whole cell cultures
- Allows for the controlled variation of frequency and duration of stimulation
- The depolarization of a user-defined area of a dissociated culture, not just those cells positioned on or near an electrode
- Enables significant increase in experimental protocol flexibility and design by readily having more control over which cells are depolarized and when while maintaining cellular viability
- Depolarize cells with specific patterns of excitation, which allows for detailed investigation of excitable cells over time
- Significantly reduces the time and skill level required to obtain excitation, in that electrophysiology techniques and equipment are not required

Photoconductive Stimulation at a Glance:

- *The photoconductive effect alters the conductivity of silicon with exposure to light*
- *Illuminate as small an area as approximately ~50 microns*
- *Stimulation protocols can be from 0.1 Hz up to 100 Hz and approximately up to a 17 volt pulse across entire surface of wafer*
- *Only illuminated neuron(s) depolarize on-demand*
- *Study cellular response using standard biochemical protocols or live imaging*
- *Non-invasive, preserves cytoskeleton, physiologically benign*
- *Concurrent electrophysiological recordings demonstrate high frequency stimulation possible*
- *Stimulation can result in controlled synaptic and network remodeling*
- *Networks formed have complex activity patterns*
- *Ion channel analysis*
- *Long term potentiation in the presence of specific controlled brain activity*
- *Depolarize cells in the presence of pharmaceutical compounds to screen for efficacy*
- *Long term analysis of cultures undergoing controlled depolarization*
- *Appropriate for use with any excitable cells, including those from the hippocampus, cortex and striatum*

More Information:

Website: www.neurosilicon.com
E-mail: contact@neurosilicon.com

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Question: Does the Photoconductive Stimulation Device (PSD) sense cellular activity?

Answer: No, the PSD does not sense any cellular activity. The device is used solely for depolarizing cells in a controlled manner. In some cases, sensing may be necessary. The PSD does operate alongside standard fluorescent imaging systems for this purpose.

Question: Do I need any "special" cells to use the PSD?

Answer: No, the PSD operates with any standard mammalian excitable cells, including neurons and cardiac myocytes.

Question: What kind of equipment do I need to prepare cells for use with the PSD?

Answer: The standard tools to culture cells are necessary. No special tools are required for this purpose. Neurosilicon does provide the silicon materials on which to culture the cells.

Question: How does the PSD stimulate cells without damaging or physically touching them?

Answer: The PSD uses a phenomenon called the Photoconductive Stimulation Effect. It is based in the principle that when visible light strikes silicon in combination with a specific current, a local field potential is generated. This LFP is what causes the cell to depolarize noninvasively without causing any damage to the cell.

Question: Do I need a microscope to use the PSD with?

Answer: Yes, the PSD does require a microscope for operation. The PSD only supports the use of a standard upright microscope with the light source coming from above.

Question: Do I need any special training to use the PSD?

Answer: No, the PSD is a standard neuroscience research tool that any skilled technician can use with the use of the appropriate documentation.

In Press:

- *Activation of microglia by neuronal activity: Results from a new in vitro paradigm based on neuronal-silicon interfacing technology.* **Brain Behav Immun**, *July. (2009)*
- *Astrocytic Ca^{2+} Waves Guide CNS Growth Cones to Remote Regions of Neuronal Activity.* ***PLoS One****; 3(11): e3692. (2008)*
- *Photoconductive Stimulation Of Neurons Cultured On Silicon Wafers.* ***Nature Protocols*** *1, 461 – 467. (2006)*
- *Neuronal Networks And Synaptic Plasticity: Understanding Complex System Dynamics By Interfacing Neurons With Silicon Technologies.* ***Journal of Experimental Biology****, 209 (Pt 12): 2312-9. (2006)*
- *Remodeling Of Synaptic Actin Induced By Photoconductive Stimulation.* ***Cell****, 107(5): 605-616. (2001)*

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