

# Neural Interfaces Conference



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# Optical Monitoring of Neural Network Connectivity Using FM1-43-Evoked Activity from Focal Stimulation of Microelectrode Arrays

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Traditionally researchers have used a variety of methods to monitor activity in biological neural networks, including patch-clamping and microelectrode arrays (MEA). Despite the effectiveness of these techniques for monitoring neural signals from individual cells, it is very difficult to identify network connectivity from each cell. This is due in part to the range in the neural network evoked by focal stimulation and due to the limitation of the small number of electrodes and predetermined location of electrodes in MEAs. Here we have developed a novel optical technique to determine neuron-neuron connectivity using the activity-dependent styryl dye, (FM1-43) in neural networks. Rat hippocampal neurons were grown on planar-type MEAs. After 3 weeks in culture, electrical current stimulation was delivered to cultured neural networks via an underlying electrode in the presence of FM1-43 dye. The fluorescent images showed the effect of focal stimulation around the stimulating electrode. A range of amplitudes and frequencies of stimulation were applied to the neural networks and the fluorescent intensity around the stimulating electrodes was analyzed. The increase of the area stained with FM dye was observed clearly by higher amplitude of stimulation rather than by higher frequency. These results suggest that FM1-43 is useful for monitoring activity-dependent synaptic events and determining network connectivity in cultured neural networks.

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