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Abstract

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Project Title:	Functional Properties of Neural Circuits for Vision

Abstract: The long-term objectives of this proposal are to understand the functional organization of feedforward and feedback pathways between the lateral geniculate nucleus (LGN) and visual cortex. For sensory systems, feedforward projections from thalamic relay cells provide the cortex with information about the external environment. The cortex, in turn, sends extensive feedback to thalamic relay cells. The cortex thus functions both to process information supplied by the thalamus as well as to influence dynamically the transmission of thalamic input. The proposed studies involve three sets of experiments. The first set of experiments deals with the issue of what role magnocellular and parvocellular LGN inputs play in the construction of postsynaptic receptive fields in layer 4C of visual cortex. Recordings will be made from monosynaptically connected neurons in the LGN and layer 4C in order to compare the organization of pre- and postsynaptic receptive fields as well as to assess the dynamics of synaptic transmission. The second set of experiments deals with determining the physiology of corticogeniculate feedback neurons located in layer 6 of visual cortex. Neurons in layer 6 that provide feedback input to the LGN are located in the upper third and lower third of the layer. Neurons in the upper third project exclusively to the parvocellular geniculate layers; neurons in the lower third project primarily to the magnocellular layers. We will examine the physiological properties of these neurons to determine whether they are differentially sensitive to visual stimuli. If so, then it seems likely that neurons in the upper and lower regions of layer 6 should be able to differentially modulate activity traveling in the magno- and parvocellular streams. The third set of experiments deals with the functional influence of cortical feedback on geniculate activity. By recording from ensembles of geniculate neurons, we will determine whether cortical feedback selectively influences the activity of neurons in the magno- and parvocellular layers of the LGN. If feedback is found to influence the temporal patterns of LGN activity, then we will examine data from the first set of experiments to determine the efficacy of these patterns in driving cortical responses. Results from this work will not only increase our understanding of how visual information is processed by the nervous system, but will provide a framework for understanding the functional relationship that exists between thalamus and cortex. Only by such a detailed understanding of the normal balance between feedforward and feedback interactions can disorders of this relationship, such as appear in

many forms of epilepsy, be understood.

Thesaurus Terms:
lateral geniculate body, neural information processing, neural transmission, synapse, thalamus, vision, visual cortex
biofeedback, epilepsy, neuroanatomy, neuron, neurophysiology, visual stimulus
Macaca mulatta, electrode, electrophysiology, microelectrode, statistics /biometry

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