Integrating Neurophysiological Views of the Aging Visual System

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Country

USA

Title of project or programme

Integrating Neurophysiological Views of the Aging Visual System

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NIH (NIA)

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4

The project/programme is most relevant to:

Alzheimer's disease & other dementias

Keywords

optic flow, Event-Related Potentials, Visual system structure, neurophysiology, Visual Motion

Research Abstract
DESCRIPTION (provided by applicant): Single neuron neurophysiology has identified mechanisms of optic flow analysis in macaque dorsal extrastriate cortex (Duffy 2004). We have shown that optic flow perceptual deficits are associated with navigational impairments in aging

and Alzheimer’s disease (AD) (O’Brien 2001) (Mapstone 2010). Recently, we linked these lines of research by recording human optic flow event related potentials (ERPs), finding that they are highly correlated with perceptual and navigational impairments in aging and AD (Kavcic 2006) (Fernandez 2007). We have now recorded optic flow ERPs in monkeys, creating an opportunity to relate ERPs to the growing understanding of the cellular neurophysiology underlying visual motion processing. These efforts will elucidate the cortical mechanisms of optic flow analysis and its decline in aging and AD. We hypothesize that components of optic flow ERPs are specifically linked to the effects of bottom-up dorsal stream visual motion processing, and top-down attention and task related mechanisms thought to originate in posterior parietal (PPC) and dorso-lateral prefrontal (DLPFC) cortices. We will test this hypothesis in studies of monkeys viewing sequential optic flow stimuli during a memory guided saccade task. These studies will integrate the recording of single neurons in cortical area MSTd with the recording of LFPs in STS (superior temporal sulcus), PPC, and DLPFC, and with the recording of ERPs in a full cranial array. We will take three parallel approaches to probing the cortico-cortical interactions that link optic flow analysis to behavioral task demands and ERPs. First, we will analyze the co-variation in the responses of single neurons, LFPs, and ERPs to understanding the neurophysiological foundations of ERP components. Second, we will use age-related variation in ERP components to test for correlated variation in single neuron and LFP responses. Third, we will use pharmacological reversible inactivation to establish relations between specific cortical areas, ERP components, and the underlying neurophysiological response mechanisms. Understanding the neural mechanisms of visual motion processing, and its relationship to age-related changes in behavior, will promote the detection and amelioration of navigational impairments in aging and AD.

Lay Summary

Neurons in monkey dorsal extrastriate cortex process the visual motion in optic flow to support navigation. Navigational impairments in aging and Alzheimer’s disease (AD) are associated with deficits in optic flow perception and changes in both sensory and attentional components of optic flow cortical evoked responses. We will now combine the recording of single neuron responses, local field potentials, and event related potentials in monkeys engaged in an optic flow related behavioral task. Our goal is to elucidate the origin and function of sensory and attentional responses to optic flow. These studies will identify the neural mechanisms underlying the debilitating navigational impairments that limit functional independence in aging and AD.

Further information available at:

Types:
Investments > €500k

Member States:
United States of America

Diseases:
Alzheimer's disease & other dementias

Years:
2016

Database Categories:
N/A

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