The entorhinal cortex and aerobic exercise in aging

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Country

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The entorhinal cortex and aerobic exercise in aging

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1

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Research Abstract

? DESCRIPTION (provided by applicant): The overall goal of this project is to investigate the response of the entorhinal-hippocampal memory system to aerobic exercise training in initially

physically inactive, healthy seniors. Entorhinal-hippocampal communication is critical for successful navigation and context-dependent memory formation. This region shows profound pathology in Alzheimer’s disease. Entorhinal and hippocampal atrophy rates accelerate with age in cognitively intact seniors, who also show impaired navigation and reduced activity in hippocampal and parahippocampal areas during allocentric navigation. Allocentric navigation is a form of flexible navigation that depends on successful encoding of relationships between landmarks in the environment. Physical exercise consistently appears as one of the most effective interventions to attenuate cognitive decline in Alzheimer’s disease, and promotes healthy cognitive and brain aging, including the hippocampus. The entorhinal cortex has direct projections to the dentate gyrus, the neurogenic zone of the hippocampus, which is known to respond strongly to exercise in animal models. Environmental enrichment promotes not only hippocampal integrity, but also in- creases cortical thickness in the entorhinal cortex in rodents. Animal research has demonstrated that physical exercise is one of the critical variables for environmental enrichment induced brain changes. In humans, it is currently unknown what mechanisms underlie these changes, and if aerobic exercise has an impact on entorhinal integrity and entorhinal-hippocampal communication. It is fundamentally important to fill this knowledge gap, because the entorhinal cortex sits at the epicenter of inputs to the hippocampus, serving as a gateway for cortical-hippocampal communications. We hypothesize that the entorhinal cortex and entorhinal-hippocampal communication are primary functional/anatomic targets of aerobic exercise. In two Specific Aims we seek to test the hypothesis that entorhinal functional integrity and entorhinal-hippocampal functional connectivity during memory task performance (Specific Aim #1) and during allocentric navigation in a virtual environment (Specific Aim #2) are enhanced following exercise training in initially physically inactive seniors and that this enhancement is positively related to changes in cognition. We will also investigate whether particular subsets of participants, such as those with poor performance on spatial reasoning tests or those with greater entorhinal atrophy, might be more responsive to aerobic exercise. To investigate these aims, we will use a randomized, controlled clinical trial of exercise training with baseline and follow-up assessments of behavioral performance on cognitive tasks of entorhinal and hippocampal integrity, aerobic fitness, and brain function using high-resolution functional and structural MRI techniques optimized for examining the entorhinal-hippocampal memory system. The proposed project is directly relevant to the mission of the National Institute on Aging through its focus on understanding the neurobiological underpinnings of the aging process with the goal to promote healthy cognitive and brain aging through lifestyle changes.

Further information available at:

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