Research Statement (ISL Faculty Affiliate Application)
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My research program seeks to understand – *and ultimately strengthen* – the neural systems that support real-world episodic memory: the ability to form, consolidate, and intentionally retrieve personally meaningful events. Episodic memory is foundational to independent living, social connection, and a sense of identity, yet it is highly vulnerable to normative aging and to age-associated neurodegenerative and neuropsychiatric conditions. Across these trajectories, memory decline is closely linked to dysfunction in hippocampal–cortical circuitry, including altered connectivity and network dynamics. My work combines cognitive neuroscience theory, advanced neuroimaging, and noninvasive neuromodulation to (1) identify mechanisms of age-related cognitive decline, and (2) translate those mechanistic insights into scalable interventions that promote "living well" across the lifespan.

A central focus of my lab is the hippocampal–cortical network (HCN), a systems-level circuit that supports episodic memory through interactions between the hippocampus, medial temporal lobe cortex, and distributed cortical hubs. Using fMRI connectivity and multivariate methods, we test how specific patterns of network interaction relate to successful memory formation and later retrieval, and how these relationships change with age or risk status. In parallel, I use individualized, network-targeted transcranial magnetic stimulation (TMS) – *including theta-burst patterned stimulation (TBS)* – to causally probe (and potentially enhance) hippocampal-network function. This approach allows us to move beyond correlation by directly testing whether modulating network dynamics produces predictable changes in memory behavior, and whether distinct stimulation patterns can selectively shape circuit function.

My research program aligns tightly with the mission and goals of the Institute for Successful Longevity: understanding mechanisms of age-associated cognitive decline; developing holistic interventions to counter those declines; and disseminating knowledge that improves quality of life for older adults and their caregivers. My work specifically addresses cognition as a pillar of successful longevity, while also intersecting with health and mobility through outcomes that matter for everyday functioning (e.g., remembering appointments, medication routines, goals, and personally meaningful experiences). I am particularly enthusiastic about contributing to ISL's multidisciplinary model, which explicitly recognizes that successful aging requires integrated perspectives spanning cognition, health, mobility, and the broader context of older adulthood.

Looking ahead, my near-term research plans emphasize two translational directions that would benefit from deeper engagement with ISL. First, I am developing studies that test whether network-targeted TBS can enhance memory in midlife and older adults, and whether stimulation-induced changes in hippocampal–cortical connectivity predict who benefits most. These projects naturally contribute to ISL's goal of moving from discovery to intervention, while also generating mechanistic biomarkers that can inform clinical research. Second, I am advancing mobile, naturalistic assessment tools that capture autobiographical memory and real-world cognition outside the lab. Pairing memory cueing and longitudinal follow-up with neuroimaging and neuromodulation offers a scalable path to intervention research that can reach broader populations, including those for whom frequent in-person visits are burdensome. This direction aligns well with ISL's growing emphasis on advanced technology, data-driven approaches, and practical innovations that support older adults in daily life.

As an ISL Faculty Affiliate, I would contribute an experimentally rigorous, theory-driven cognition program that bridges basic systems neuroscience and intervention development. I am eager to collaborate with ISL investigators across basic science, clinical research, and technology-focused initiatives, sharing tools for causal inference, individualized targeting, and brain–behavior modeling. I also see clear synergy with ISL infrastructure, including opportunities to recruit and engage older adult community members through the ISL Participant Registry for studies focused on cognitive aging and memory-based interventions. Ultimately, my goal is to help advance ISL's mission by producing actionable knowledge about the mechanisms of cognitive decline and by developing evidence-based, scalable strategies to help older adults remain active, independent, and fully engaged in life.