

## IMPACT OF AGE-RELATED PERTURBATIONS ON A BUMP ATTRACTOR MODEL OF WORKING MEMORY

Normal aging in humans and non-human primates is associated with progressive cognitive decline, particularly in working memory, which is governed by the dorsolateral prefrontal cortex (dlPFC). During aging, the dlPFC undergoes pronounced alterations, including myelin loss, synapse loss, and neuronal hyperexcitability. Although extensive experimental data exist, a coherent theoretical framework explaining how these changes interact to alter network dynamics is still lacking. Here, we investigated how aging-related factors contribute to working memory decline using bump attractor network models of spatial working memory. The network consists of sparsely connected excitatory and inhibitory integrate-and-fire neurons and incorporates short-term synaptic facilitation and depression (Hansel and Mato, 2013). Myelin loss was implemented as an increased action potential failure rate (Ibañez et al., 2023), and neuronal hyperexcitability was introduced via empirically fitted age-related changes to the neuronal  $f-I$  curve (Ibañez et al., 2020). Our results show that biologically plausible levels of myelin loss and hyperexcitability produce substantial working memory impairment via distinct mechanisms. Hyperexcitability causes broader neuronal activity and increased correlations, leading to greater diffusion of the activity bump and less precise memory representations. In contrast, myelin loss selectively reduces bump amplitude, lowering memory stability over time and impairing memory duration. Introducing spatial distractors at varying times revealed distinct patterns of memory drift. In hyperexcitable networks, distractors closer in space and time exert stronger effects, whereas in demyelinated networks, more distant distractors have greater impact. Together, these findings demonstrate how age-related neural changes differentially impair working memory and suggest potential targets for intervention.