Network models predict that pyramidal neuron hyperexcitability and synapse loss in the diPFC lead to age-related spatial working memory impairment in rhesus monkeys
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INTRODUCTION

Using computational models, we studied how age-related changes in the properties of individual pyramidal neurons (PNs) in the layer 3 of area 46 (diPFC), in the rhesus monkey, relate with the impairment of their spatial working memory (SWM).


2. *In vitro* & *in vivo* studies: PNs undergo structural & electrophysiological changes with aging. Spatial information is encoded in the persistent firing activity of PNs in the dlPFC during a SWM task. Thus, perturbations of their properties in aging are likely to be a significant determinant of declines in SWM.

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1. PN hyperexcitability and synapse loss in the dlPFC together may be sufficient to explain empirically observed performance. In successful networks, lower excitatory & inhibitory weights partially compensated for increased PN excitability.

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RESULTS

1. (empirical) Rhesus monkeys show DRSTsp impairment and increased AP firing rates of diPFC PNs with aging, and a negative correlation of the DRSTsp span with the AP firing rates.

2. The DRT model shows an optimal level of PN excitability to maximize successful performance. In successful networks, lower excitatory synaptic weights and higher inhibitory weights partially compensated for increased PN excitability.

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DRSTsp model: modeling memory retention in the DRSTsp based on the DRT setup, plus short-term synaptic facilitation.

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