Cortical Ensembles Based on Dendritic Plateau Generation in the Prefrontal Cortex

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Presentation Abstract Summary Prefrontal cortex (PFC) performs executive functions which require the selection of relevant information from a set of choices. Building on prior neural-assembly models, our embedded-ensemble encoding theory (EEE) hypothesizes that dendritic plateaus put sets of cells into a Standby state, providing one assembly, or ensemble. The standby ensemble is drawn on to provide embedded transient subensembles through synchronized firing. This hypothesis is supported by the observation of dendritic plateaus in cortical pyramidal neurons in Layer 5 of the PFC.

We simulated a PFC columnar network with a connectivity that leads to dendritic plateaus, and studied subpopulations of neurons in Standby or Synchronized states. Excitatory pyramidal neurons in L5 were optimized to generate dendritic plateaus. L5 pyramidal neurons receiving long-range inputs to their basal dendrites induced dendritic plateaus and high frequency firing in comparison with the Off subpopulations. The generation of dendritic plateaus induced Standby and Synchronized ensembles in our PFC network model and may be essential for the processing of multimodal cortical information.

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