*PandaCite: A Python Based Enhanced Citation Manager*

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Abstract  
The modulation of synaptic transmission via artificial ion channels represents a frontier in neuroadaptive engineering. We report the design and simulation of a novel class of voltage-gated synthetic ion channels (VG-SICs) that dynamically alter conductance profiles based on predicted cognitive demand in silico. Using the RodentMind v2.5 simulation framework, we introduced VG-SICs into layer V pyramidal neurons and monitored performance across virtual maze navigation tasks. DOI: Panda et al. (2020)

Cognitive plasticity was assessed using adaptive learning rates derived from Hebbian feedback loops. Results demonstrated a 48% enhancement in task acquisition speed compared to control networks (p < 0.001), with VG-SIC activity correlated to theta phase locking. These findings were further supported by gradient-based interpretability analyses which revealed upregulation of metaplastic subnetworks during critical learning windows. Grant et al. (2025)

Interestingly, long-term simulation revealed emergent oscillatory phenomena consistent with biologically observed sharp-wave ripples, suggesting partial biorealism. While hardware deployment remains a challenge, the proposed VG-SIC system paves the way for neuromorphic co-processors that flexibly adapt to real-time cognitive loads. Zhu et al. (2022)

References

**References**

1. Grant, Luke, Vanderkelen, Inne, Gudmundsson, Lukas, Fischer, Erich, Seneviratne, Sonia I., et al., Global emergence of unprecedented lifetime exposure to climate extremes - Nature. Nature. (2025). doi: 10.1038/s41586-025-08907-1

2. Panda, Pritam Kumar, Arul, Murugan Natarajan, Patel, Paritosh, Verma, Suresh K., Luo, Wei, et al., Structure-based drug designing and immunoinformatics approach for SARS-CoV-2. Science Advances. 6, (2020). doi: 10.1126/sciadv.abb8097

3. Zhu, Shaotong, Sridhar, Akshay, Teng, Jinfeng, Howard, Rebecca J., Lindahl, Erik, et al., Structural and dynamic mechanisms of GABAA receptor modulators with opposing activities. Nature Communications. 13, (2022). doi: 10.1038/s41467-022-32212-4