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Presentation Abstract

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Presentation Title:	Rapid dynamic changes of dendritic feed-forward inhibition in the dentate gyrus during state transitions
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Abstract:	The dentate gyrus (DG) serves as a primary gate to control information transfer from the cortex to the hippocampus. Activation of incoming cortical inputs results in rapid excitation followed by feed-forward inhibition onto DG granule cells (GCs). GABAergic (γ-aminobutyric acid-releasing) inhibitory interneurons (INs) comprise non-adapting, fast-spiking (FS) and adapting, non-fast-spiking (non-FS) cells. Detailed morphological analysis of DG INs reveals that FS cells are soma-targeting INs, whereas non-FS cells are dendrite-targeting INs. These two classes of INs are differentially recruited by specific input patterns and in turn provide exquisite spatiotemporal control over GC activity to regulate the amount of excitation that gets through to the hippocampus. However, whether FS and non-FS cells proportionally translate their activities into output synapses has yet to be addressed. Here, we show that feed-forward inhibition in the DG is dominated by somatic GABAergic inputs during sparse spiking modes (‘Down’-states), whereas dendritic GABAergic inputs are rapidly switched on and maintain reliable and powerful inhibition during clustered spiking modes (‘Up’-states). The variant dynamics of dendritic GABAergic inputs is modulated by presynaptic activities and is likely attributed to loose coupling between Ca2+ sources and synaptic vesicles. Furthermore, the extent of dynamic changes of GABA release can be reduced by blocking voltage-gated K+ channels, which leads to potentiation of dendrite-targeting IN output

synapses during sparse spiking modes. Such rapid dynamic modulation of dendritic feed-forward inhibition may act as a frequency-dependent filter to prevent over-excitation of GC dendrites and thus set the excitatory-inhibitory balance in the DG circuits.

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INTERNEURON

FEED-FORWARD INHIBITION

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