Past and Future Annual Meetings

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Sections +

Neuroscience 2005 Abstract

Presentation Number: 274.8

Abstract Title: A γ-β frequency transition generated by inter-areal communication in the hippocampus *in vitro.*

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Primary Theme and Topics Neural Excitability, Synapses, and Glia: Cellular Mechanisms
- Network interactions
-- Oscillations and synchrony

Session: 274. Oscillations and Synchrony: Models and Theory
Poster

Presentation Time: Sunday, November 13, 2005 4:00 PM-5:00 PM

Location: Convention Center Exhibit Hall, Poster Board O6

Keywords: oscillation, doublet, interneuron, pyramidal

Gamma oscillations are generated in area CA3 of the hippocampus both in vitro and in vivo (Fisahn et al., 1998; Csicsvari et al., 2003). Here we present experimental and network simulation data to elucidate the mechanism of the generation of CA3-driven gamma and beta oscillations in area CA1. (1) The frequency of area CA1 output generated by gamma input from area CA3 was dependent on the degree of recruitment of CA1 principal cells. Passive involvement of area CA1 principal cells resulted in a gamma frequency oscillation. Active involvement of CA1 principal cells transformed this gamma oscillation into one at beta frequencies. (2) This beta oscillation in area CA1 was dependent on CA1 recurrent excitation. (3) It was also dependent on the temporal relationship between feedforward excitation of CA1 interneurons (by CA3 output) and feedback excitation of CA1 interneurons (by CA1 output). That is, the network beta oscillation in area CA1 depended on doublet firing of certain interneurons driven by area CA3. (4) The interneuron doublet rate during beta corresponded to whether or not dendrites are oriented horizontally or vertically: Interneurons with vertically oriented dendrites (eg. basket cells and - to a lesser extent - bistratified cells, all receiving input from CA3) fired considerably more doublets than interneurons with horizontally oriented dendrites (horizontal alveus cells or olm cells) which are not contacted by area CA3 and hardly ever fired doublets during beta. Taken together the findings demonstrate that different interneurons can serve different purposes during a given network oscillation, that single interneuron subtypes can mediate multiple network frequencies, and that the frequency of output from a cortical region serves to signal the degree of principal cell recruitment.

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