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FEATURED ORAL PRESENTATION



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Control of gamma vs beta competition in olfactory bulb by the balance between sensory input and centrifugal feedback control

François David¹, Emmanuelle Courtiol^{1,2}, Nathalie Buonviso¹, Nicolas Fourcaud-Trocmé^{1*}

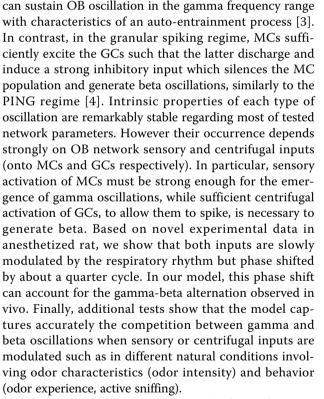
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Gamma (40-80Hz) and beta (15-40Hz) oscillations and their associated neuronal assemblies are key features of neuronal sensory processing. However, the mechanisms involved in either their interaction and/or the switch between these different regimes in most sensory systems remain misunderstood. The mammalian olfactory bulb (OB) expresses both gamma and beta oscillations, which appear to be mutually exclusive, and a slower one related to respiration (2-10Hz). Gamma oscillations have been linked to odorant physical properties (quality, intensity) while beta oscillations are strongly increased by odor experience (for reviews see [1,2]). Importantly, the occurrence pattern of these two fast alternating oscillations is intermingled with the respiratory slow rhythm which provides a window for odor discrimination. Based on in vivo recordings and biophysical modeling of the mammalian olfactory bulb (OB), we explored how OB internal dynamics and the balance between sensory and centrifugal inputs control the occurrence and alternation of OB gamma and beta oscillations over a respiratory cycle.

In the OB, fast oscillations originate in the dendrodendritic interaction between excitatory mitral cells (MCs) and inhibitory granule cells (GCs). Experimental evidence has shown that GC dendritic arbor can operate in two modes: a local mode which effectively allows a weak inhibition between MCs without requiring GC spikes, and a global mode which induces a strong inhibition of MCs following GC spikes. We implemented these two inhibitory mechanisms in a parsimonious and flexible OB model based on generalized integrate-and-fire models.

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In the granule non-spiking regime, the weak inhibition

Overall the model approaches very closely OB dynamics observed in vivo, and can thus be used to interpret present and future experiments.

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