Neuroscience data talk

The role of astrocyte calcium signaling in developing sensory domains

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Spontaneous neuronal activity emerges from developing sensory organs before they can respond to the external world. The mechanisms through which this highly stereotyped neuronal burst firing induces maturation of sensory systems remains poorly understood. Astrocytes, one of the major glial cell types in the brain, promote the formation and function of neuronal synapses; however, it has not been possible to monitor the activity of these distinct cell types in living animals during this crucial period of circuit refinement. Using selective genetic manipulations and in vivo imaging in awake mouse pups, we demonstrate that astrocytes and neurons exhibit highly coordinated spontaneous activity before the onset of hearing within sound processing regions of the auditory midbrain and cortex. Astrocyte calcium events occurred in response to the most intense neuronal events and were mediated by synergistic activation of two types of metabotropic glutamate receptors on astrocytes. Coordinated activity between neurons and astrocytes was restricted to a narrow developmental time window, disappearing after hearing onset. Transcriptional profiling of the developing auditory midbrain in mice with genetic silencing of astrocyte calcium signaling revealed that both astrocyte and neuron maturation relied on astrocyte activity during this period. These results show for the first time the involvement of astrocyte calcium signaling in the maturation of neuronal circuits within the intact brain, advancing our understanding of how neuronal burst firing is used to promote brain development. Identifying astrocytes as mediators of this process provides potential new therapeutic targets for treating neurodevelopmental disabilities, such as autism spectrum disorder.

Tuesday, June 13, 2023 04:00pm - 05:00pm
Central Bldg / O1 / Mondi 2 (I01.O1.008)

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