FBS Graduate School of Frontier Biosciences Osaka University

Osaka University

Brain Science Special Seminar

An autocrine purinergic loop controlling astrocyte-induced modulation of neuronal activity revealed by optogenetics

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Time : 16:00-17:00
Place: 2F Seminar Room of Biosystems Building, Suita Campus

Astrocyte-derived gliotransmitters glutamate and ATP modulate neuronal activity. It remains unclear, however, how astrocytes control the release and coordinate the actions of these gliotransmitters. In a first part of my talk, I will show how the use of optogenetics helped us recently to address this issue (Shen et al., Scientific Reports 2017). Using transgenic expression of the light-sensitive channelrhodopsin 2 (ChR2) in astrocytes, we observed that photostimulation reliably increases action potential firing of hippocampal CA1 pyramidal neurons. This excitation relies primarily on a calcium-dependent glutamate release by astrocytes that activates neuronal extra-synaptic NMDA receptors. Remarkably, our results show that ChR2-induced Ca^{2+} increase and subsequent glutamate release are amplified by ATP/ADP-mediated autocrine activation of P2Y1 receptors on astrocytes. Thus, astrocyte-induced neuronal excitation in CA1 is promoted by a synergistic action of glutamatergic and autocrine purinergic signaling in these glial cells. This new mechanism may be particularly relevant for pathological conditions in which ATP extracellular concentration is known to increase. In a second part of my presentation, I will report on unpublished data indicating that this loop is indeed involved in the changes of synaptic transmission produced in the dendate gyrus by pathological concentrations of the inflammatory cytokine TNFα.

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後援：新学術領域研究「非線形発振現象を基盤としたヒューマンネイチャーの理解」