3P230 線虫においてあるモダリティーが異なるモダリティーの順応を引き起こす

Sensory stimulation from a specific modality adapts a different modality in *Caenorhabditis elegans*

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In study on *C. elegans*, the neural functions and circuits have been revealed at just single sensory modality, but it is unknown how a specific modality influences others. Here, we showed that chemotaxis to specific volatile odorants decreased by 5 min pre-exposure to gustatory cue (Mg2+) by behavior assay, suggesting that the cross modality adaptation is observed in *C. elegans*. A specific neuron ablation with a phototaxis protein, KillerRed, revealed that AIY interneuron, which is projected by olfactory and gustatory sensory neurons, required for this adaptation. The function of AIY was also confirmed by intracellular Ca2+ measurement. The Ca2+ response to odor stimulation was diminished by the adaptation, also indicating that AIY is necessary for the adaptation.

3P231 集光レーザービームの光摂動による神経細胞内分子動態の集合操作

Optical perturbation of intracellular molecular dynamics of single neuron in living neuronal network

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Intracellular molecular dynamics at synaptic terminals in neurons are essential for synaptic plasticity and subsequent modulation of neuronal network. For aiming artificial control of synaptic activity, we demonstrate optical perturbation of synaptic vesicles and neural cell adhesion molecules (NCAMs) at plasma membrane in living neurons with optical tweezers. Synaptic vesicle dynamics and NCAMs labeled with Q-dots in an optical trap obtained from fluorescence correlation spectroscopy were revealed that the particle motion was constrained at the focus due to optical trapping force. Optical manipulation suppressed releasing synaptic vesicles after high K⁺ stimulation, suggesting that our method has a potential to manipulate synaptic transmission at single synapse level.

3P232 記憶学習中枢海馬の性差：海馬内ホルモン変動とシナプス変動

Sex difference in hippocampus: Fluctuation of hippocampal sex hormones and synapses

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The hippocampus, a center for learning and memory, is not sex different at the anatomical level such as its number of neurons. Nevertheless, the significant sex difference exists in the performance of hippocampus-dependent task such as spatial memory. To date, hippocampal sex difference had been attributed to the blood hormone level.

However, we revealed that the hippocampal level of sex hormones is much higher than the blood level. Moreover, hippocampal levels of female sex hormones (estradiol and progesterone) were sex different and those in female fluctuated across a 4 day-period (estrous cycle), with a high correlation with spine density (postsynapse).

Hippocampal sex difference at synaptic level may be due to the difference in hippocampal hormonal level.

3P233 老化に伴う海馬神経シナプスの密度の減少と記憶の劣化 Age-related decrease in synapse density of hippocampal neurons in relation to memory impairment

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We investigated the spine (postsynapse) density in hippocampus center for learning and memory. We found the age-related decrease in the spine density and change in morphology, indicating a reduction of memory performance.

The density of spines of 3 months rats (young) and 24 months rats (aged) was analyzed with Spiso-3D mathematical software. In aged rats, spine density (1.71 spines/μm) was decreased from young rat (2.29 spines/μm). The density of large-head spine and middle-head spine was significantly lower in aged rats. We found the considerable decrease in testosterone to 1/100 in aged rat hippocampus, by using LC-MS/MS. The testosterone replacement therapy rescued the spine density. Note that BDNF was not at all decreased by aging.

3P234 Acute Modulation of Synaptic Plasticity of Pyramidal Neurons by Hippocampal-derived Sex Steroids

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Hippocampal-derived sex hormones are neuromodulators in the hippocampus. We investigated effects of Estradiol(E2), Testosterone(T) and Dihydrotestosterone(DHT). Adult hippocampus synthesized 8nM E2. Synaptic estrogen receptors(ERα) are in spines of hippocampal neurons. Localization of ERα in spines was demonstrated by immunogold electron microscopy. We demonstrated that E2 induced the long term potentiation (LTP) of the hippocampal neurons by weak theta burst stimulation. E2 also increased the density of spines in CA1 pyramidal neurons in hippocampal slices. Effects of E2 are induced by mitogen-activated protein kinase (MAPK) in hippocampal neurons.

3P235 脳海馬が作る男性・女性ホルモンは記憶の神経シナプスを増強する

Hippocampus-synthesized male and female hormones increase memory-related nerve synapses

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Dendritic spines are postsynapses which store the memory in the hippocampus. We already demonstrated that sex hormones are synthesized locally in the hippocampus. We focus on the rapid effect of male and female hormones on the synaptic plasticity. Following a 2 h treatment, the density of spines was significantly increased. Mathematic analysis by Spiso-3D software distinguished kinase signaling induced by these sex hormones. The signaling of androgen and estrogen involve synaptic estrogen and androgen receptors, which drive PKC, PKA and MAPK, resulting in actin polymerization and new spine formation.