2P230 ヨーロッパモノアラガイの中枢神経系における神経活動の膜電位イメージング (II)

Fluorescent Voltage Imaging of the Neural Activity in the Central Nervous System of the Pond Snail (II)

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Some neurons spontaneously fire and often exhibit complex activities. We have found that a regulatory neuron (cerebral giant cell; CGC), which is involved in feeding responses, in the cerebral ganglion of the pond snail *Lymnaea stagnalis* shows regular beating, regular bursting and irregular bursting discharges depending on the d.c. current through the cell membrane. In the present study, we examined how the activities of CGC affect the neural activities of the buccal ganglion (BuG) by using fluorescence voltage imaging technique. The activities of CGC were measured simultaneously by intracellular recording using a glass electrode. The fluorescence images showed that the firing patterns of some neurons in the BuG were affected by the discharge of CGC.

2P231 マウス海馬スライスに見られる時空間活動パターンに対する解析法の提案

An analysis method for spatiotemporal activity patterns in mouse hippocampal slices

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Recently, functional multineuron calcium imaging (fMCI), which enables us to access brain function with single-neuron resolution, has been developed. We have observed various spatiotemporal activity patterns in the CA1 region of mouse hippocampal slices by fMCI. For example, some dozens of neurons fired incoherently in some slices, while they exhibited more coherent activity patterns in other slices. In the present study, we propose an analysis method to evaluate the coherency of the neural activity patterns and the similarity among each neural activity pattern. As a result, the analysis showed the neural activity under a higher K⁺ concentration and the existence of bicuculline became more frequent but incoherent than the normal condition.

2P232 マウス海馬スライスの CA1 領域における様々な時空間活動パターンのレーザー共焦点イメージング (II)

Laser confocal imaging of various spatiotemporal activity patterns in the CA1 region of mouse hippocampal slices (II)

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Recently, functional multineuron calcium imaging (fMCI), which enables us to access brain function with single-neuron resolution, has been developed. In the present study, we observed spatiotemporal activity patterns in the CA1 region of mouse hippocampal slices by fMCI. The slices (350 μ m) were prepared from 1-week-old male ddY mouse. The slice preparation was stained with a Ca²⁺-sensitive dye, Oregon green. The stained slice was illuminated by an Ar laser (488 nm; 532-B5-A04, Melles Griot), and the 520 nm fluorescence images were acquired through a Nipkow confocal unit (CSU-10, Yokogawa) and a CCD camera (iXon X3 897, Andor). As a result, some dozens of neurons fired incoherently in some slices, while they exhibited more coherent activity patterns in other slices.

2P233 視索前野の GABA 作動性神経とオレキシン神経の機能的結合について

Functional connection between GABAergic neurons in the preoptic area and orexinergic neurons in the hypothalamus

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The preoptic area (POA) GABAergic neurons are thought to be important for driving and maintaining sleep, whereas orexinergic neurons in the lateral hypothalamus maintain wakefulness. Our research team examined the functional connectivity between the GABAergic and the orexinergic neurons using channelrhodopsin 2 (ChR2). ChR2 was expressed selectively in the POA GABAergic neurons using AAV-mediated gene transfer. We found that ChR2-expressing neurons projected to the lateral hypothalamus and the fibers were located adjacent to orexin neurons. Optogenetic stimulations of GABAergic fibers or cell bodies resulted in a strong inhibition of activity of orexin neurons both in vitro and in vivo. We revealed that the POA GABAergic neurons functionally connect to orexin neurons.

2P234 青斑核ノルアドレナリンニューロンへのオレキシン 2 型受容体を介した GABA 作動性の抑制性入力

GABAergic inhibition of noradrenergic neurons through orexin type 2 receptors

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The locus coeruleus (LC), the noradrenergic (NA) nucleus in the pons, plays pivotal roles in generating and sustaining the state of wakefulness and REM sleep. Orexin neurons are also involved in the maintenance of wakefulness. Orexin neurons excite NA neurons in the LC through orexin type-1 receptors (OX1Rs). Recently, it is found that orexin type-2 receptors (OX2Rs) are expressed in GABAergic neurons in and around the LC. Using patch-clamp recordings in the mouse LC slices, we investigated the functions of OX2Rs on the LC GABAergic neurons. Activation of OX2Rs reduced spontaneous firing of NA neurons. The effect was not observed after blockade of GABA_ARs. These results suggest that orexin neurons could inhibit NA neurons through OX2R-mediated GABAergic transmission.

2P235 アリの探索における記号創発

Emergence of symbol in ant navigation

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Ant visual navigation is well studied with respect to taxon-like navigation or map-like navigation. Little evidence has been obtained in support of map-like navigation. We here generalize the idea of landmark navigation by navigation based on visual cues and their paired accessibility, which is expressed by a topological system, and predict that an ant can learn the relationship between a collection of visual cues and a collection of accessible sites. Here, we demonstrate that the garden ant *C. japonicus* can perform AND and XOR logical operations for the accessibility of visual cues, and also that ants can generate emergent symbol of which many cues combined by OR is united as one cue.