PROJECTIONS OF THE OPTIC TECTUM IN RAINBOW TROUT *ONCORHYNCHUS MYKISS*

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To investigate the output pathways from the optic tectum in rainbow trout, we examined the tectal projections by a tract-tracing method. Biocytin was applied to the optic tectum. Labeled terminals were detected in the nucleus dorsomedialis thalami, nucleus ventromedialis thalami, nucleus pretectalis superficialis, nucleus pretectalis, nucleus pretectalis periventricularis, corpus glomerulosum, torus longitudinalis, nucleus ruber of Goldstein (1905), ventral regions of the torus semicircularis, nucleus isthmi, and bilateral ventral regions of the medulla. Among these nuclei, cells projecting to the optic tectum were also labeled in the nucleus dorsomedialis thalami, nucleus ventromedialis thalami, torus longitudinalis, nucleus ruber of Goldstein (1905), torus semicircularis, and nucleus isthmi. These nuclei are considered to interact reciprocally with the optic tectum. On the other hand, tectal projections to the telencephalon were not detected. This fact shows that the visual information processed in the optic tectum reaches the telencephalon mediated plausibly by diencephalic relay nuclei in rainbow trout.

CURRENT SOURCE DENSITY ANALYSIS OF PROJECTION OF NUCLEUS ISTHMI TO BILATERAL OPTIC TECTUM OF THE FROG

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Nucleus isthmi (NI) of the frog is located at tegmentum in the midbrain and known to contribute to binocular vision. NI receives the only input from ipsilateral optic tectum, and projects back to ipsi- and contralateral optic tectum. Current source density analyses were performed on field potentials of the optic tectum in response to electrical stimulation of nucleus NI. Information originated from R1/2 fibers of both contralateral retina and NI projected to the same neurons in superficial layer, but information from R3/4 fibers projected to different neurons. Ipsilateral NI projects to a single layer where R3/4 fibers from contralateral retina terminate. The results support the idea that prey information from ipsilateral retina (R1/2 fibers) should terminate to the same neuron as that from contralateral retina as frogs fixate and eat prey in binocular field, but predator information should be received by independent pathway in wider visual field.

EFFECTS OF ROSCOVITINE, A CDK5 INHIBITOR, ON SYNAPTIC TRANSMISSION IN THE RAT CEREBELLAR CORTEX

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While cyclin-dependent kinases (cdks) are implicated in cell proliferation and differentiation, a member of cdks, cdk5 is abundantly expressed in the axons of postmitotic neurons in the brain. We thus explored roles of cdk5 in CNS synapses by using a cdk5-specific inhibitor, roscovitine, and whole-cell recordings from neonatal rat cerebellar slices. Synaptic responses were evoked by an electrical stimulation in the molecular layer and recorded from Purkinje cells (PCs). Bath application of roscovitine (30 μM) enhanced both basket cell-mediated inhibitory transmission and parallel fiber-mediated excitatory transmission onto PCs, but did not significantly affect climbing fiber-mediated excitatory transmission. Roscovitine increased the frequency, mean amplitude and decay time constant of tetrodotoxin-insensitive miniature inhibitory postsynaptic currents in PCs, whereas it enhanced only the frequency of miniature excitatory synaptic currents. These results suggest that roscovitine-sensitive, that is, cdk5-dependent mechanisms differently contribute to the regulation of cerebellar synaptic transmission at presynaptic and postsynaptic sites.

SELECTIVE INFLAMMATORY STIMULATIONS ENHANCE RELEASE OF AIF-1/ MRF-1 FROM CULTURED RAT MICROGLIA

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mrf-1 is upregulated in response to neuronal death and degeneration both *in vitro* and *in vivo* in microglia. When microglia were treated with ATP, the amount of MRF-1 that was released increased 10-fold compared to the basal level of release. The enhancement was induced within 10 min, peaked within 1 h, and returned to normal after ~4 h. MRF-1 release was stimulated by 2-MeS-ATP (5-fold), and a $P2X_7$ selective agonist, Bz-ATP (10-fold). The ATP-stimulated release was inhibited by a $P2X_7$ selective antagonist, oATP, and under a Ca^{2+}-free condition. MRF-1 release was also enhanced by Ca^{2+}-ionophore A23187, thapsigargin partially, not enhanced by glutamate or LPS. Moreover, a platelet-activating factor enhanced microglial MRF-1 release. A conditioned medium from cerebellar granule neurons undergoing apoptosis also increased microglial MRF-1 release; that effect was significantly inhibited by oATP. These results indicate that selective inflammatory stimulations enhance MRF-1 release from microglia through a Ca^{2+}-dependent mechanism, and suggest that MRF-1 may play a role in cell-cell interactions under inflammatory conditions.

CHANGES IN SYNAPTIC EFFICIENCY OF HIPPOCAMPAL GRANULE CELLS DURING OPERANT BEHAVIOR IN RATS

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It is widely accepted that neuronal plasticity, e.g. LTP and LTD, is important for memory and learning. However, no one has observed these phenomena at a time when an animal is committing a new piece of information to memory. We electrophysiologically monitored the efficacy of synaptic transmission from the perforant path (PP) to the granule cells in the dentate gyrus (DG) of freely moving rats over the course of training in an appetitively motivated and discriminated operant paradigm. Evoked potentials were recorded from the DG following stimulation of PP every 15 sec, and the field EPSP (fEPSP) slope and the amplitude of population spike (PS) were measured. We found that significant increase of 5-10 % in fEPSP slope and significant decrease of 40-50 % in amplitude of PS during the lever pressing from the day of acquisition of operant behavior task. Namely, inputs from the entorhinal cortex were increased and outputs to the CA3 were decreased in the DG. These results suggest that gating mechanism may be performed in the DG for cutting off unnecessary sensory information for operant behavior task in the acquisition process.

ROLE OF SUBSTANCE P RECEPTOR EXPRESSING STRIATAL INTERNEURONS IN FORELIMB MOVEMENTS

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In the striatum, substance P receptor (SPR) is expressed in two types of interneurons. To characterize modulatory effects of striatal interneurons upon the output nucleus of the basal ganglia of the rat, we ablated these SPR expressing striatal interneurons with substance P-saporin, a receptor specific neurotoxin. We then made extracellular recordings of the activity of entopeduncular neurons and examined their responses to stimulation in the motor cortex. In the interneuron-ablated animals, the spontaneous discharge rate of entopeduncular neurons was significantly decreased, and proportion of entopeduncular neurons showing responses to cortical stimulation was significantly larger, in comparison with intact animals. Furthermore, we examined the performance of skilled forelimb movements after ablation of the striatal interneurons. Rats were trained to advance their hands through a narrow slot, and grasp pasta pieces arranged in the pasta matrix. Ablation of the striatal interneurons resulted in significant decrease the number of obtained pasta pieces. The results suggest that the striatal interneurons expressing SPR participate in motor control for skilled forelimb momements.

NEUROGENESIS OF HIPPOCAMPAL CELLS BY THYROID HORMONE IN THE HYPOTHYROIDAL MUTANT MOUSE

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It has been known that thyroid hormone deficiency in early life causes failure of CNS development and results in decreased mental faculties and movement disorders in humans. Since the growth-reterded (*grt*) mutant mouse exhibits growth retardation due to congenital hypothyroidism, the mutant seems to be a suitable model for investigating the human hypothyroidism. In the present experiments we examined the effect of thyroid hormones on proliferation of hippocampal cells in the *grt* mouse. Proliferation of hippocampal cells was studied by counting BrdU-incorporated cells in the subgranular zone (SGZ) of the dentate gyrus in the *grt* mouse. At 3 weeks of age, BrdU-incorporated cells were markedly decreased in number in mutant mice as compared to normal littermates. Treatment of mutant animals with triiodothyronine obviously increased the number of BrdU-incorporated cells to the level of normal animals. Furthermore, BrdU-incorporated cells were specifically stained by neuronal cell makers. These results suggest that thyroid hormone plays an important role in the neurogenesis of cells in the SGZ. Studies on thyroid hormone action in neurogenesis in vitro are in progress.