PREPRO-TACHYKININ GENE EXPRESSION IN THE HONEYBEE *APIS MELLIFERA* L. BRAIN

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We identified a tachykinin-related peptide, termed AmTRP, from the mushroom bodies (MBs) of the honeybee *Apis mellifera* L. brain using direct matrix-assisted laser desorption/ionization with time-of-flight mass spectometry and isolated its cDNA. *In situ* hybridization showed that the prepro-AmTRP gene is expressed predominantly in the MBs in the honeybee brain. Furthermore the amount of prepro-AmTRP transcripts changed according to division of labor, suggesting AmTRP peptide functions as a neuromodulator associated with age/division of labor-selective behavior and/or physiology of the honeybees.

MECHANISMS OF ACTION OF A PEPTIDE MOLECULE, HYM355, WHICH ACTIVATES THE NERVE DIFFERENTIATION IN HYDRA.

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Peptides which have activities on developmental processes such as morphogenesis or cell differentiation were identified in the course of a systematic screening of peptide signal molecules in hydra. One of them is Hym355 (FPQSFLPRGamide) that is a neuropeptide and activates the nerve differentiation in hydra. In the present study, the mechanisms of action of Hym355 was examined in hydra. Results show that the target process of Hym355 action is the first step of the nerve differentiation: the commitment of stem cells into the nerve differentiation.

PERIPHERAL NEURAL CIRCUIT IN THE FOOT OF GASTROPOD, *PLEUROBRANCHAEA*

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The pedal nerves, three bilaterally paired nerves, arise from the pedal ganglia and innervate the foot in *P. japonica*. One of these nerves, the posterior pedal nerve (pPN), runs along the side of the sole toward the tail, and both side of the pPN join together in the tail region. There are many ganglion-like structures along the course of the pPN from which small collaterals are sent out. About 30 neuronal somata were observed in a pair of the largest ganglion-like structures located in the most posterior portion of the nerve. As a result of Co^{2+} and / or Ni^{2+} filling at the distal cut-stump of pPN, some neuronal somata were stained in the ipsilateral ganglion-like structure. Some axons passed through the ipsilateral structure and extended to the contralateral one. In response to stimulation applied to the distal cut-stump of the pPN, a burst discharge of impulses was recorded from the contralateral pPN. However, no one-for-one impulses were observed following stimulation pulses with a constant latency. The results suggest that there are excitatory connections from the efferent axons in the pPN to contralaterally located peripheral neurons with ascending axons.

CENTRAL PROJECTIONS OF ANTENNAL CONTACT CHEMOSENSORY NEURONS IN THE BRAIN OF THE COCKROACH

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The deutocerebrum of the insect brain is the primary processing center for antennal sensory information and is divided into modality-specific neuropils. It is illustrated so far that the antennal lobe is the olfactory, hygro- and thermosensory center, while the dorsal lobe is the mechanosensory center. We have investigated central projections of contact chemosensory neurons housed in a bristle with a terminal pore on cockroach antennae. Electrophysiological responses to stimulus solutions of KCl and NaCl were recorded from the largest bristle distributed around the peripheral margin of each flagellar segment. Extracellular staining showed that five axons terminated individually in ordinary glomeruli in the antennal lobe, and one axon branched in the dorsal lobe and terminated in the suboesophageal ganglion. An antennal bristle of the cockroach is reported to contain one to seven sensory neurons, one of which is a mechanosensory neuron and remainder are contact chemosensory neurons. Therefore, we assigned one with an axon in the dorsal lobe as a mechanosensory neuron and the other five with axons in glomeruli as contact chemosensory neurons.

N- AND R-TYPE CALCIUM CHANNELS ARE INVOLVED IN THE INCREASE OF PACEMAKER POTENTIALS OF GnRH NEURONS BY GnRH PEPTIDE

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Gonadotropin-releasing hormone (GnRH) secreting neurons make tight cell clusters in the terminal nerve (TN) of a teleost, the dwarf gourami. We have demonstrated that TN-GnRH neurons show an intrinsic pacemaker activity, whose frequency is increased by 2-4 folds by the application of GnRH peptide, and this increase occurs via the activation of endogenous GnRH receptors in a paracrine or autocrine manner. The precise mechanism of this GnRH-induced firing-rate increase has not been fully explained in TN-GnRH neurons. In the present study, we showed electrophysiologically that voltage-gated calcium channels in TN-GnRH neurons are mainly composed of T-, N- and R-type calcium channels, and N- and R-type calcium channels play important roles in the GnRH-induced increase of firing frequency. We suggest that GnRH released from TN-GnRH neurons facilitates their own pacemaker activity by regulating membrane ion currents via N- and R-type voltage-gated calcium channels and cause synchronized positive feedback facilitation of multiple TN-GnRH neurons. This mechanism may be common to other neurosecretory or endocrine cells, whose synchronized facilitation of firing leads to facilitated release.

EFFECTS OF PROSTAGLANDIN RECEPTOR STIMULI ON NEUROGENESIS IN THE DENTATE GYRUS OF THE ADULT RAT.

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Neurogenesis in the dentate gyrus (DG) of adult rodents is elicited by transient global ischemia. Cyclooxygenase (COX)-2, a limiting enzyme for prostanoid synthesis, is also induced by ischemia. To clarify whether prostaglandin (PG) E2 synthesis by COX is involved in neurogensis, ONO-DI-004 (EP1 agonist), ONO-AE-248 (EP3 agonist) or ONO-8711 (EP1 antagonist) was injected into the rat hippocampus. ONO-DI-004 injection caused an increase in the number of 5-bromo-2-deoxyuridine (BrdU)-positive cells in the subgranular zone (SGZ), and the effect of ONO-DI-004 on cell proliferation was inhibited by preinjection of ONO-8711. ONO-AE-248 injection did not cause an increase in the number of BrdU-positive cells. These results suggest that PGE2 plays an important role in the proliferation of cells in the SGZ via EP1 receptor.

INTEGRAL OF EVOKED LOCAL CEREBRAL BLOOD FLOW IN RAT SOMETOSENSORY CORTEX IS MAINLY DETERMINED BY ARTERIOLE SUPPLY.

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It has been reported that evoked local cerebral blood flow (LCBF) is moderated by stimulus intensity, although it is unclear which vessels control the integral evoked LCBF. Using Laser-Doppler flowmetry we can simultaneously measure LCBF and erythrocyte concentration and velocity in a localized area. The erythrocyte concentration and velocity are, respectively, thought to relate to changes in capillary and arteriole volumes when the somatosensory cortex is activated. The present study investigated the mechanisms for evoked LCBF adjusting to stimulus intensity. It was found that the rise time of the erythrocyte concentration was faster than that for erythrocyte velocity, whereas the peak time of the erythrocyte concentration was slower than the erythrocyte velocity for all stimulus intensities. These results suggest that initial capillary expansion is followed by arteriole relaxation. Also, the slope of the erythrocyte concentration between the rise and peak times was constant with increasing stimulus intensity, but this was not so for the erythrocyte velocity. This suggests that the integral evoked LCBF is controlled by arteriole wrt stimulus intensity.

EVOLUTION OF CEREBELLUM AND CEREBELLAR BASAL NUCLEUS: D11 MONOCLONAL ANTIBODY AS SPECIFIC MARKER FOR EURYDENDRIC NEURON.

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Cerebellum of vertibrates is composed of two parts: cerebellar cortex and basal nucleus. The latter part is located at the center of the cerebellum and suppressed by the Purkinje neuron in the cortex. However, the basal nucleus, which is common in higher vertebrates, is not found in lower vertebrates, like bony fishes. Eurydendric cells, located in the Purkinje layer, are thought to be an output neuron instead of the basal nucleus of the higher vertebrates. Monoclonal antibody D11 recognized large neurons in zebrafish cerebellar cortex. The Purkinje neuron, which is recognized by another monoclonal antibody M1, is not stained by this D11 antibody. D11 immunopositive cells are found in the Purkinje layer and slightly larger than Purkinje neurons. The number of the immuno positive cells is smaller than that of Purkinje neurons (about 10 %). On the other hand, the D11 antibody does not stain Purkinje neurons. These results indicate that the D11 monoclonal antibody recognizes eurydendric neuron, but not Purkinje neuron.