DEVELOPMENT OF THE CNS AND SEROTONIN-IMMUNOREACTIVE PROCESSES IN THE OPISTHOBRANCH MOLLUSC *PLEUROBRANCHAEA JAPONICA*.

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We studied development of the CNS and distribution of serotonin-immunoreactive neurons during a period from the embryo to the young juvenile just after metamorphosis in *Pleurobranchaea japonica*.

We observed the CNS with thin sections obtained from preparations embedded in Quetol-812 under a light optics. The basic shape in the CNS such as the cerebro-pleural, pedal and buccal ganglia and the rudiments of the rhinophore and oral veil ganglia was settled during the veliger phase. The rhinophore and oral veil ganglia were extruded from the cerebro-pleural ganglion after metamorphosis.

Processes serotonin-immunoreactive to anti-serotonin antiserum were found in thick paraffin sections and whole mount preparations by means of PAP and FITC method for, respectively, paraffin sections and whole mounts. At the veliger stage serotonin-immunoreactive cells were observed in the cerebro-pleural and pedal ganglia. A cluster of immunoreactive cells was found on the larval cerebral commissure. The cluster sent processes along edges of paired velar lobes. After metamorphosis the cluster on the cerebral commissure disappeared. It is likely that the cluster was a specific neural organization for the veliger.

PROPERTIES OF DUAL EXCITATORY INNERVATION OF THE UROPOD MUSCLES IN CRAYFISH.

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In crayfish uropod, neuromuscular responses in muscle fibers of both tonic and phasic muscles which received dual excitatory innervation were observed in order to know the functional relationship between the two excitatory motor neurons. All of the muscle fibers investigated in such muscles exhibited no characteristic difference in their innervation pattern and in their neuromuscular responses. This suggested that the two excitatory motor neurons within the muscles equally distributed their terminals to all muscle fibers. In tonic muscle fibers, it appeared that two simultaneously observed trains of excitatory junctional potentials, which accurately reflected the activity of each excitatory motor neurons, were independent from each other, both in the absence and the presence of stimulations. The phenomena showing the direct or close interaction between the two excitatory motor neurons were not observed either centrally or peripherally except for the simple summation of the excitatory junctional potentials induced by the activity of individual excitatory motor neurons. In phasic muscle fibers, whose excitatory motor neurons were normally silent, no peripheral interaction between the two excitatory motor neurons was also suggested by the observation of excitatory junctional potentials and active responses induced by selective electrical stimulation of individual neurons. Central interaction, however, is unknown. An interesting feature was the different action of the individual excitatory motor neuron which innervated the adductor exopodite. Postsynaptic events induced by one of the two excitatory motor neurons was apparently rapid fatigue, while the action of another was constant. The meaning of this difference needs to be resolved. It is likely that individual excitatory motor neurons act independently on demands of different behavioral performances.

RESPONSE OF OSCILLATORY FIELD POTENTIAL TO SOME CONDITIONED ODORS IN SLUG'S BRAIN.

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To understand the mechanisms of olfactory recognition and leaning, we analyzed odor-information flow and its expression in the slug's brain using morphological and physiological technique.

An odor information caught by numerous sensory cells on tentacle tip was transferred to input mass of pro-cerebral lobe and meso-cerabral robe of brain via tentacle ganglion. The pro-cerebral lobe (PCL) was divided morphologically into three mass (cell mass, input mass and output mass). The cell mass was a cluster of cell body of intrinsic neurons, of which process elongated into output mass passing through input layer.

Local field potential (LFP) was recorded from the cell mass or output mass of PCL on tentacle-brain preparation which dissected from the body. When the appetitive-conditioned odor was applied on the tentacle tip, the frequency of LFP increased during stimulation. However, application of aversive-conditioned odor decreased the frequency. Similar results were obtained on the output-mass of PCL-tentacle preparation which was dissected from meso-cerebral lobe.

These observations suggested that an olfactory stimulus sensed on the tentacle tip was transferred into PCL and recalled the memory associating with the odor in it.

NONLINEAR ANALYSIS OF CERCAL SENSORY PATHWAY

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Signal transmission pathway to giant interneuron 8-1 in the cricket cercal sensory system was clarified by using Wiener's white noise analysis. Air current stimulus was modulated with a Gaussian white noise signal of 500 Hz band width. Responses of the interneuron were recorded by intracellular electrode. The stimulus and response waveforms were stored on a digital-audio-tape recorder and collected into a workstation through GPIB interface. The linear signal transmission was estimated from the cross-correlation between stimulus and response. The 2nd order cross-correlation between stimulus white noise at two different times and response indicates the contribution of 2nd order nonlinearity to the signal transmission. Nonlinear signal transmission gave a good clue to determine the sequence of processing element in signal flow to the interneuron. Interneuron 8-1 was revealed to receive bilateral inputs. Both showed strong amplitude saturation but with different threshold. The high threshold input has 1 ms delay and was subtracted from the other at the interneuron. Subtraction of delayed signal helps to detect the rate of change of stimulus.