be concerned with where in the retina a clear image just in focus was formed. It means that a clear image just in focus may be encoded to distance sensitive neurons, but a blur image, that is out of focus on the retina, may be not encoded. However, this idea includes some difficult problems. First, how clear is the image just in focus formed on the retina? Second, does a contour of the image contrast largely differ between images in focus and out of focus? Third, how is only a clear image on the retina encoded in a so-called distance sensitive neuron? To answer these questions optical performance of the corneal lens was examined by geometric and wave optics in the eye of the tiger beetle larva. The results are discussed in reference to how images of moving objects perceived by a receptor cell depending upon their distances.

ELECTROPHYSIOLOGICAL PROPERTIES OF VOLTAGE-GATED Na^+ CURRENTS IN FROG PARATHYROID CELLS

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Frog parathyroid cells display transient inward currents in response to depolarizing pulses from a holding potential of -84 mV. In the present study, we analyzed the biophysical properties of the inward currents using perforated and conventional whole-cell patch-clamp techniques. The inward currents disappeared by the replacement of Na^+ with $NMDG^+$ and were reversibly inhibited by 3 μM TTX. Activation of the currents occurred at -60 mV in perforated mode and at -50 mV in conventional mode, respectively. The currents reached maximal amplitude at about -20 mV in both modes. Current densities at -24 mV were -80 pA/pF in perforated mode and -55 pA/pF in conventional mode. Boltzmann fits to activation displayed that the currents were half activated at -50 mV in perforated mode and -45 mV in conventional mode. The voltages of half inactivation were -78 mV in perforated mode and -86 mV in conventional mode. Recovery from inactivation followed a single-exponential time course. Time constants (τ) were 9.6 ms in perforated mode and 13.0 ms in conventional mode. The results suggest that the Na^+ currents in frog parathyroid cells may be modulated by intracellular metabolism.

FUNCTIONAL PROPERTIES OF THE EXTRA-OCULAR PHOTORECEPTORS IN THE *ONCHIDIUM* GANGLIA

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Some identified extra-ocular photoreceptors, the photoresponsive neurons which respond directly to light without the aid of any eye photoreceptors, exist in the abdominal ganglion of the mollusc *Onchidium verruculatum*. The named Ip-2/Ip-1 of these neurons respond to light with a hyperpolarizing receptor potential, caused by opening the cGMP-activated K^+ channels. The present study was conducted to examine the functional properties of these Ip-2/Ip-1, having a peak sensitivity at a 510 nm light. When the amounts of light transmitted through the animal's body wall were measured, it was suggested that the body wall transmits enough 510 nm light to hyperpolarize Ip-2/Ip-1 in vivo. Ip-2/Ip-1 cells, having either spontaneous beating or bursting spike activity were coupled with weak electrical synapses. The first order photosensory cells, Ip-2/Ip-1 were also the second order interneurons relaying other sensory inputs and innervating the pneumostome and viscera. Details of the function of the concerned cells are currently under investigation.

ANALYSIS OF RAB5 FUNCTION ON SYNAPTIC VESICLES AND SECRETORY GRANULES

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Rab5, a member of small GTPase, is well known as a regulator of endocytic vesicular transport from plasma membrane to early endosomes. Recently, we demonstrated that rab5 on synaptic vesicles of *Drosophila* functions to keep the size of vesicles uniform by preventing their homotypic fusion. In contrast, rab5 was not involved in the endocytic reformation of synaptic vesicles, contrary to expectation from its conventional function. Furthermore, we electrophysiologically and behaviourally showed that the function of rab5 is essential for efficient signal transmission across synapses. In this study, we carried out mechanistic analysis of the rab5-mediated homotypic fusion using the secretory cells we newly identified at the proximal region of the posterior Malpighian tubule. In the cells, rab5 was localized on secretory granules. Exocytosis of the granules was controlled with intracellular Ca^{2+} concentration, which could be visualized with fluorescent dye, FM 1-43. Expression of GDP- or GTP-form of rab5 in the cells revealed that rab5 facilitates the homotypic fusion of the granules in GTP-dependent manner, but not influences the fusion of the granules with plasma membrane.

PEPTIDERGIC MODULATION OF THE CONTRACTILE ACTIVITY OF THE SPHINCTER IN THE ABDOMINAL AORTA OF *APLYSIA KURODAI*

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At the base of the abdominal aorta of *Aplysia*, there is a sphincter that regulates the blood flow into this artey. Contractile activity of this muscle is modulated by three types of *Aplysia* peptides (NdWFamide, enterin, AMRP). NdWFamide enhances the contraciton of the sphincter evoked by the nerve stimulation, and enterin and AMRP depress the contraction. Because pharmacological experiments suggest a possibility that the peptides act on the excitatory nerve terminals, we analyzed the effects of peptides on spontaneous excitatory junctional potentials (sEJPs) in the sphincter. We found that NdWFamide increases the frequency of sEJPs, and that AMRP reduces the frequency. These results suggest that the peptides modulate the excitatory transmitter release in the sphincter.

DISTRIBUTION OF GnRH NEURONS IN *HALOCYNTHIA RORETZI* (PLEUROGONA)——COMPARISON WITH THAT OF *CIONA INTESTINALIS*

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In Ciona, most of GnRH neurons are distributed from near the posterior surface of the cerebral ganglion to the base of the gonoducts. On the other hand, in Halocynthia roretzi, GnRH neurons are distributed along the dorsal strand within the blood sinus from the posterior part of the cerebral ganglion to over half of the body, but no gonoducts exist there. Just beneath the surface of the gonads attached to the both sides of body wall, gonoducts locate and open to the atrial siphon. GnRH neurons run beneath its epithelium. The largest difference from Ciona is the existence of many GnRH neurons within the cerebral ganglion. They project to various parts of the bady, such as tentacle, body wall muscle, surface of the gonads, branchial basket. That is, it seems that, in Halocynthia roretzi, GnRH neurons play many functions as well as reproduction.

STRUCTURES AND FUNCTIONS OF NEWLY IDENTIFIED BIOACTIVE PEPTIDES OF A PROSOBRANCH GASTROPOD, *THAIS CLAVIGERA*

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The organic tins such as tributyl tin in seawater induce the formation of male-reproductive organs in female (imposed sexual organs) of the prosobranch gastropod. Recently, the possibility is pointed out that the malfunctioning of neuropeptide systems by organic tins is responsible for this phenomenon. However, information on neuropeptides of the prosobranch is not sufficient to evaluate this hypothesis correctly. In this study, we attempt to elucidate the structures and functions of neuropeptides in a prosobranch, *Thais clavigera*. After the successive fractionation with HPLC, which was followed by either a bioassay or an immunological assay, we purified about 50 of positive materials from the peptidic extracts prepared from 500 of the animal. Structural analysis revealed that the purified materials contained five novel peptides, as well as some well-known ones such as FMRFamide and APGWamide. Most of the peptides tested modified the contraction of the esophagus, penis and sex-accessory glands. These results suggest that prosobranch has well-developed neuropeptide systems, which regulate the physiological activities of digestive and reproductive systems.

CHANGES IN ELECTRICAL ACTIVITIES WITH AGING IN CRICKET FLIGHT MUSCLES

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Cricket (*Gryllus bimaculatus*) flight muscles degenerate markedly with aging. Muscle weight increases during the first 2 - 3 days after imaginal moult. Then the color of the muscle surface becomes pale and the muscle weight decreases. Flight behavior is the highest on the 2nd day after imaginal moult and then gradually declines. Muscle action potentials elicited by nerve stimulation were recorded intracellularly at neuromuscular junctions of flight muscles 112a and 119 and abdominal muscle 202 during 7-day (112a) and 35-day periods (119 and 202) following imaginal moult. The firing level for a muscle action potential was estimated by measuring the magnitude of depolarization to the deflection point on the rising phase of the muscle action potential. In muscles 112a and 119, the firing level gradually fell during the first 2 - 3 days