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ANTICOMPENSATORY FAST EYE MOVEMENTS IN THE HORIZONTAL AND VERTICAL VESTIBULO-OCULAR REFLEXES

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Besides compensatory slow phases (CSPs) the ocular responses to vestibular stimulation include anticompensatory fast phases (AFPs), the amplitude of which and frequency depend upon the stimulation plane. We studied in rabbits and cats the vertical (VVOR) and horizontal (HVOR) vestibulo-ocular reflexes to investigate whether the amplitude of AFPs was greater than that of CSPs. In HVOR, AFPs were larger than CSPs and the final eye positions were anticompensatory in both species. On the contrary in VVOR the AFPs were smaller in cats and abolished in rabbits. Therefore the final eye positions were near the midline in cats and had a compensatory position in rabbits. The difference between HVOR and VVOR was attributed to otolithic influence on AFPs. In fact AFPs were present in VVOR 90° nose up in rabbits and larger in VVOR 90° side down in cats. In these positions the macular contribution to the reflex was null. Thus it appears that otolithic influence on AFPs causes gaze stability to be higher in the vertical than in the horizontal plane. The elevated density of ganglion cells in the horizontal visual streak should be taken into account to explain such enhanced gaze stability in the vertical plane.

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PRE AND POSTSYNAPTIC EXCITATORY ACTION OF GLUTAMATE ON THE FROG VESTIBULAR RECEPTORS

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Several evidences (R.P. Bobbin et al., Exp. Brain Res. 34:389-393, 1979) suggest that Glutamate (Glu) or a related substance may be the chemical transmitter at the afferent synapses in the acoustico-lateralis system. Intracellular recordings of EPSP and spike activity from single primary afferents of frog semicircular canals revealed that Glu has complex excitatory effects. In fact it operates both on the hair cells (i.e. presynaptically), causing an enhanced release of the natural transmitter, and on the primary afferents (i.e. postsynaptically), eliciting a long-lasting membrane depolarization. The excitatory amino acid antagonists 2-amino-5-phosphonopentanoic acid (AP5), as well as cis-2,3-piperidine dicarboxylic acid (PDA) and γ D-glutamyl-glycine (DGG), depressed spontaneous activity in the semicircular canals, causing disappearance of spiking and marked depression in the amplitude and frequency of the EPSPs. AP5 was slightly more effective than PDA and DGG in depressing the resting activity and also in impairing the Glu-induced responses. The results point to the presence both in the hair cells and in the primary afferents of different excitatory amino acid receptor sites. They do not disprove a possible role of Glu or of a related substance as afferent transmitter, however disclose a possible function of Glu as a modulator of the afferent transmission at the frog vestibular organs.

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MORPHOLOGICAL BASIS OF PURKINJE CELL MULTIPLE INNERVATION BY CLIMBING FIBERS

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In mammals, the one-to-one relationship between climbing fibers (CF) and Purkinje (Pk) cells, typical of the adult cerebellum, is preceded by a transient stage of multiple innervation. The regression of the redundant synaptic contacts is not due to cell death but to a loss of axon collaterals by the inferior olive (IO) neurons. In the adult, individual IO neurons contact several Pk cells through a number of axonal branches that according to IO and Pk cell counts is 10 in the cat. The analysis of the spatial distribution of these collaterals indicates that individual IO neurons only send axon collaterals to homologous areas of the body maps, replicated in different cerebellar lobes (A Rosina and L Provini, J. Comp. Neurol. 256: 317-328, 1987).

We have here studied incidence and distribution of the IO interlobar branches in newborn kittens, in comparison with the pattern of the adult, by injecting spectrally different retrograde markers into homologous cerebellar areas. We have found that in the first postnatal week the interlobar branches are indeed more numerous - by a factor of about 2 - in terms of doubly projecting neurons.

These preliminary results suggest that the supernumerary fibers to be withdrawn during postnatal development are, at least in part, interlobar IO axon collaterals. Their regression may significantly contribute to the final shaping of the somatotopy of CFs found in the adult.

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THE INFLUENCE OF INDOMETHACIN ON THE FROG PAPILLARY RECEPTORS

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We studied the electrical response of fungiform papilla receptors in frog tongue to stimulating solutions of $CaCl_2$ after indomethacin administration through peritoneum, abdominal vein and onto lingual mucosa. Indomethacin, when administered by intraperitoneal and vascular route, produced a small and delayed inhibition of the response of taste receptors to $CaCl_2$ solutions only at high concentrations (1.10^{-3}M). On the contrary, its application onto the lingual mucosa, even at low concentrations (1.10^{-6}M) produced an intense and immediate enhancement in receptor responses. Therefore it is evident that the apical extensions of the sensorial cells (L.Gioglio et al., J. Morphol. **195**:1-16, 1988) are the most sensitive component to indomethacin. This localised influence can be correlated with the properties of the internal systems of microtubules and microfilaments typically involved in the control of the cytoplasmic Ca^{++} level. The facilitating effect of indomethacin is therefore consistent with an increase of Ca^{++} in the sensory cells. In these cells indomethacin probably inhibits the arachidonic acid cascade which in turn might be the responsible for increased activity of diacylglycerol and inositoltriphosphate due to the hydrolysis of the phosphatidylinositol present in the receptor membranes. Consequently we suggest that Ca^{++} release from intracellular stores and phosphorilation of functionally active proteins by protein kinase C could contribute to electrical papillary activation in the frog tongue.

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