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AMPLITUDE DISTRIBUTION OF HIPPOCAMPAL THETA AND BETA FIELD POTENTIAL COMPONENTS: EXPERIMENTAL RESULTS AND SIMULATIONS.

J. Holsheimer and J. Boer.

During θ -rhythm and β -activity a high degree of synchronization between the membrane voltage fluctuations of neurons in several parts of the hippocampal complex (HC) exists, resulting in high amplitude field potentials (FP) in these areas. Amplitude and phase relations of θ -FP, resp. β -FP in different layers of these areas may provide information about the activation site at the somadendritic membranes of the resp. neuronal populations, and about the functional relations of these parts of HC during θ -rhythm, resp. β -activity.

FP were recorded simultaneously with a fixed and a moving semi-microelectrode (against reference) in the CA1 field, fascia dentata and hilus of the dorsal HC of the urethane anesthetized rat during θ -rhythm. Frequency analysis was applied to epochs of both signals at each position of the moving electrode. For the θ ($4\frac{1}{2}$ -5 c/s), resp. β (15-55c/s) component of the FP amplitude and phase profiles were made as a function of the anatomical location. θ -rhythm as well as β -activity had phase reversals, coupled with amplitude minima, in str. radiatum of CA1 and in the molecular layer of the dentate area. θ -rhythm had an amplitude maximum at the fissure and the β maximum was in the hilus.

The membrane potentials simulated by a compartmental model (Rall) of a CA1 pyramidal cell, a granular cell and a hilus cell have been used for calculation of their joint FP by a volume conductor model. Simulation of only few combinations of simultaneous local activation of the 3 cells led to FP-profiles similar to the profiles found experimentally for the θ -, resp. the β -component of the FP. This result leads to 2 alternatives for the simultaneous synaptic activation of CA1 pyramidal cells and dentate granular cells during θ -rhythm, resp. β -activity.

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CALCULATION OF THE CONDUCTION VELOCITY OF SHORT NERVE FIBRES; G.H. van der Vliet, J. Holsheimer and D. Bingmann.

Normally the conduction velocity (v) of a nerve fibre is calculated from the time interval between the action potentials (a.p.) recorded by two electrodes along the fibre. In fibre preparations with a length of some mm, however, this method does not yield reliable results. This is due to a combination of two factors: the time delay (Δ) is short in comparison with the duration of the recorded a.p. and the shapes of the two a.p. usually differ owing to asymmetric recording conditions at the electrodes in short nerve fibre preparations.

In order to find a more appropriate method for the estimation of v in short nerves, several linear signal analysis methods were applied to pairs of a.p. recorded monopolarly with Pt-wire electrodes at 1-5 mm interelectrode distances from few fibre preparations of cut carotid sinus and vagal nerves in the cat. The calculations were executed on a PDP 11/40 computer.

As would be expected, the time delays estimated directly from the positions of the peaks of the a.p., from the centres of their rising phases or from the peaks of the first derivatives of the a.p. differed widely and the results of each of these methods showed a great variability. The same was found when Δ was estimated from the phase spectrogram of two corresponding a.p. at different frequencies.

However, a small variability in the results was obtained when Δ was estimated from the cross correlogram of the a.p. or when a maximum likelihood time delay estimate was calculated. The conduction velocities determined by the latter methods differed only to a small extent when the interelectrode distance was varied. Therefore these procedures proved to be appropriate for the estimation of v in short nerve fibres.

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NEURONAL CONVERGENCE FROM STRIATUM AND DORSAL RAPHE TO ANTIDROMICALLY IDENTIFIED NIGRO-STRIATAL AND NIGRO-THALAMIC NEURONS

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Concentric stimulating electrodes were placed in the striatum (ST), ventro-medial nucleus of the thalamus (VM) and the dorsal raphe (DR) in rats under pentobarbital anesthesia. Field and unitary potentials in the NI were recorded with a glass micropipette with Na-acetate and pontamine blue, with which the recording site was marked after completion of the study. Stimulation of the ST evoked a positive field potential (latency: 8-13ms, duration: 30-70ms) in NI which related to neuronal inhibition. Stimulation of the DR produced a negative field (latency: 4.4 ± 0.5 ms, duration: 38 ± 4.1 ms) which corresponded to neuronal excitation. Electrolytic lesions in ST and systematic administration of bicuculline abolished the ST-evoked positivity, and increased slightly the DR-evoked negativity. Coagulation of the DR had a contrary effect. Excitation by stimulation of the DR could be detected more frequently in pars reticulata than in pars compacta. Identification of DA-ergic or non DA-ergic nigral neurons was done by antidromic activation from ST stimulation and by systemic administration of amphetamine. Antidromic responses by stimulation of VM was observed only in pars reticulata. Our observation leads to the conclusion that the efferent neurons in pars compacta and pars reticulata of the NI receive convergence from the ST and the DR of opposite nature.

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Response pattern of visceral afferents from the cat's colon upon noxious and non-noxious stimuli
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The transformation of noxious visceral stimuli into the response pattern of visceral afferent fibres is up to now unknown; that is it is unclear whether the information on these stimuli is relayed to the CNS by specific afferent fibres or by the pattern of afferent activity which do not disclose any specificity with respect to the stimuli.

For this purpose the responses of visceral afferents in the inferior splanchnic nerves to mechanical (extension, probing) and chemical stimuli (Bradykinin, KCl, hyperosmotic NaCl, ischaemia) applied to the colon were investigated in anaesthetized cats. In total 172 fibres were examined. The conduction velocities of these afferent fibres were largely below 1,5 m/s. 70 fibres had no resting activity and did in their majority not respond to any of the stimuli used. 102 fibres had resting activity and did as far as tested, with a few exceptions, respond to all stimuli applied.

Thus the visceral afferent fibres so far examined were polymodal in their stimulus-response pattern. Therefore we assume that visceral noxious events are transmitted to the CNS by polymodal visceral afferent fibres and not by specific nociceptive afferent fibres.

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