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Weaker Synaptic Inhibition in Ventral as Compared to Dorsal Rat Hippocampus: An *in vitro* Intracellular Study

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AIM

Recent reports have acknowledged the existence of functional differentiation along the longitudinal axis of hippocampus based on anatomical, biochemical and behavioral evidence obtained from septal (SH) and temporal (TH) regions of hippocampus. In view of the well-established differences in these two regions intracellular recordings were obtained from septal and temporal CA1 hippocampal pyramidal cells in order to give further insight into the complexity of intrahippocampal circuits.

METHODS

Hippocampal slices were prepared from the dorsal and ventral parts of the hippocampus of adult male rats. Electrical stimulation of Schaffer collaterals resulted in excitatory and fast- and slow-inhibitory postsynaptic potentials (EPSPs and f- and s-IPSPs, respectively) recorded from CA1 pyramidal cells.

RESULTS

In slices treated with control artificial cerebrospinal fluid (ACSF) f-IPSP peak amplitude was significantly larger in neurons located in septal (11.2±1.1 mV, n=11) as compared to temporal sections (4.8±1.2 mV, n=8) ($p<0.01$), s-IPSP peak amplitude was also significantly larger in septal (10.3±0.8 mV, n=11) as compared to temporal sections (4.6±1.1 mV, n=8) ($p<0.01$), whereas EPSP amplitude did not differ between the two areas (dorsal: 10.3±0.9 mV, n=7; ventral: 9.8±3.3 mV, n=5; $p>0.05$). In order to study f-IPSPs in isolation we treated slices with ACSF containing excitatory receptor antagonists (Kynurenic acid 1 mM, CNQX 5 mM and CPP 5 mM) and $GABA_B$ receptor antagonist (CGP35348 300 μM). Under these conditions f-IPSP amplitude was still significantly larger in neurons from septal (12.2±0.6 mV, n=14) as compared to temporal slices (9.8±0.8 mV, n=12) ($p<0,05$). In these slices EPSPs were nullified.

CONCLUSIONS

In conclusion, the temporal region of the hippocampus exhibits weaker inhibition and more excitability as compared to the septal part. It is therefore possible that functional segregation along the septo-temporal axis may be due not only to differences in respective external connections but also to differences in properties of intrinsic neuronal circuits.