P1.12.

Reducing network size decreases sharp-wave occurrence in the CA3 region of in vitro hippocampal slices

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Hippocampal sharp-waves (SPWs) are generated in the CA3 area, and propagate to the CA1 subfield via Schaffer-collaterals. Here we examined the mechanism of SPW initiation in vitro. Our working hypothesis was that when a sufficient number of pyramidal cells are concurrently firing, activity starts to build up in the recurrent excitatory network of the hippocampus. This model predicts that the larger the network is, the more frequent and regularly timed the SPW episodes are. SPWs are spontaneously present in thick (600um), submerged in vitro mouse hippocampal slices in normal excitability ACSF. We recorded field-potentials from these slices, and tested the dependence of the frequency and the interevent interval distribution of SPWs as a function of virtual network size. To decrease network connectivity and functional network size, tetrodoxin was injected into str. radiatum via a glass capillary to partially block axon potential conduction in the recurrent collateral system of the CA3. Tetrodotoxin injection reversibly decreased sharp-wave frequency (or stopped SPW generation if large injections were applied), and increased interevent interval variability without influencing the features and basic parameters of SPWs. This experiment validates the model that SPW initiation is a stochastic process, and at the same time reject models suggesting that the length of inter-SPW intervals are set by refractory or depletion mechanisms at the neuronal and/or network level.

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