Group 1-3

Synaptic integration

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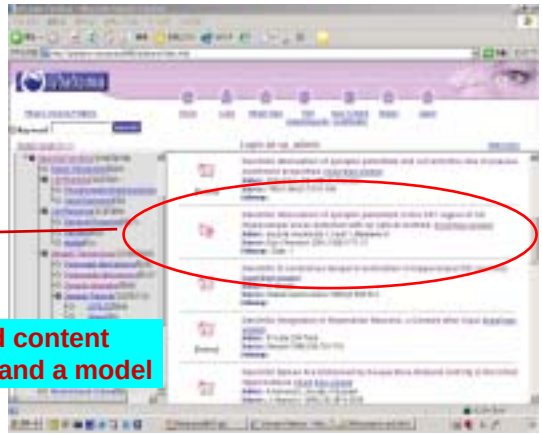
Dendritic attenuation of synaptic potentials in the CA1 region of rat hippocampal slices detected with an optical method

M Inoue, Y Hashimoto, Y Kudo, H Miyakawa,
Europ. J. Neurosci., 13 (2001) 1711-1721

We measured spread of excitatory post-synaptic potentials (EPSP) along the dendrites of hippocampal CA1 pyramidal neurons by using an optical method. To obtain passive cable parameters of pyramidal neuron dendrites, passive model neuron was constructed and parameters were optimized to reproduce the profile of experimentally obtained EPSPs.



Submitted content with data and a model

Experiments

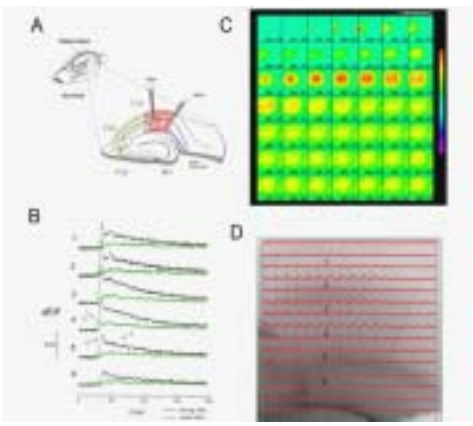
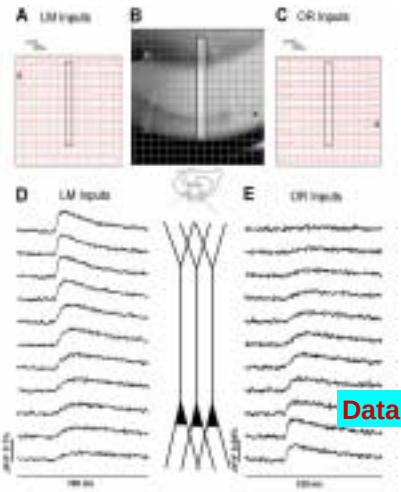


Fig.1 Rat hippocampal slices were stained with a fluorescent voltage-sensitive dye JPW1114 and optica signals were monitored with a 16 X 16 photodiode arra system at 4 kHz frame rate.

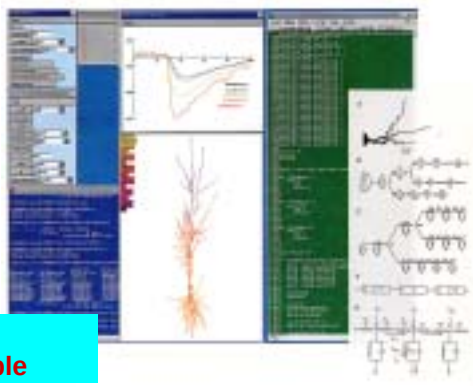


Data downloadable

Fig.2 Stimulations were delivered at stratum lacunosum-moleculare (LM) to activate perforant pathway inputs that make contacts to the distal apical dendrites or at stratum orience (OR) that make contacts to the basal basal dendrites of CA1 pyramidal neurons. EPSPs at distal apical dendrites can propagate to the soma with attenuation of amplitude with delay of time-to-peak.

Model simulations

Fig.3 Multi-compartmental passive model was consturucted using the NEURON simulator. A part of the dendrite was dynamically voltage-clamped to EPSPs obtained optically from input locations.



Model downloadable

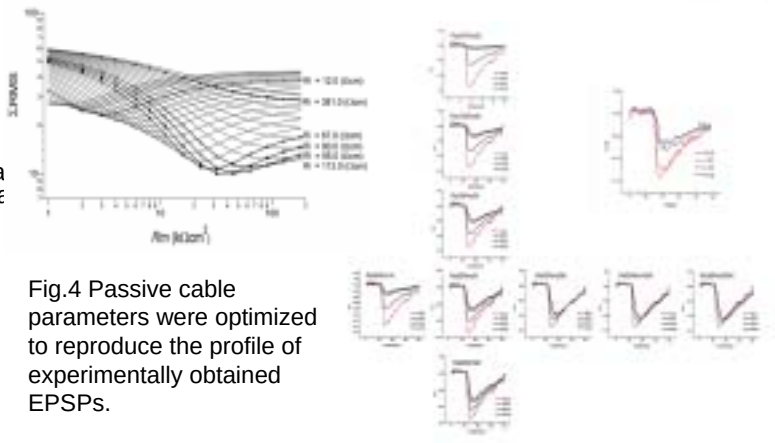


Fig.4 Passive cable parameters were optimized to reproduce the profile of experimentally obtained EPSPs.

Fig.5 Optimum sets of axial resistivity (Ra) and membrane resistivity (Rm) for LM input and OR input.