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Presentation Abstract

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Title:	How pyramidal neurons switch from integrators in vitro to resonators under in vivo-like conditions
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Abstract:	Pyramidal neurons in the intact brain are bombarded by synaptic inputs that cause tonic depolarization, shunting, and noisy fluctuations in membrane potential; by comparison, pyramidal neurons in acute slices experience little background input. Such differences in operating conditions can compromise extrapolation of *in vitro* data to explain neuronal operation *in vivo*. For instance, pyramidal neurons have been identified as integrators (i.e. class 1 neurons according to Hodgkin's classification of intrinsic excitability) based on *in vitro* experiments, but that classification is inconsistent with the ability of hippocampal pyramidal cells to resonate at theta frequency; intrinsic resonance is characteristic of class 2 neurons. Using long depolarizing stimuli and dynamic clamp to reproduce *in vivo*-like conditions in slice experiments, we show that CA1 hippocampal pyramidal cells switch from integrators to resonators, i.e. from class 1 to class 2 excitability. That switch is fully explained by the increased outward current contributed by shunting and/or adaptation, which shifts the balance of inward and outward currents active at perithreshold potentials and thereby converts the spike initiating mechanism as predicted from dynamical analysis of our modified Morris-Lecar model. Our conclusions were validated by multiple comparisons between simulation and experimental data. Thus, even so-called "intrinsic" properties may differ qualitatively between *in vivo* and *in vitro* conditions.
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