RESONANCE AND SELECTIVE COMMUNICATION VIA BURSTS IN NEURONS HAVING SUBTHRESHOLD OSCILLATIONS

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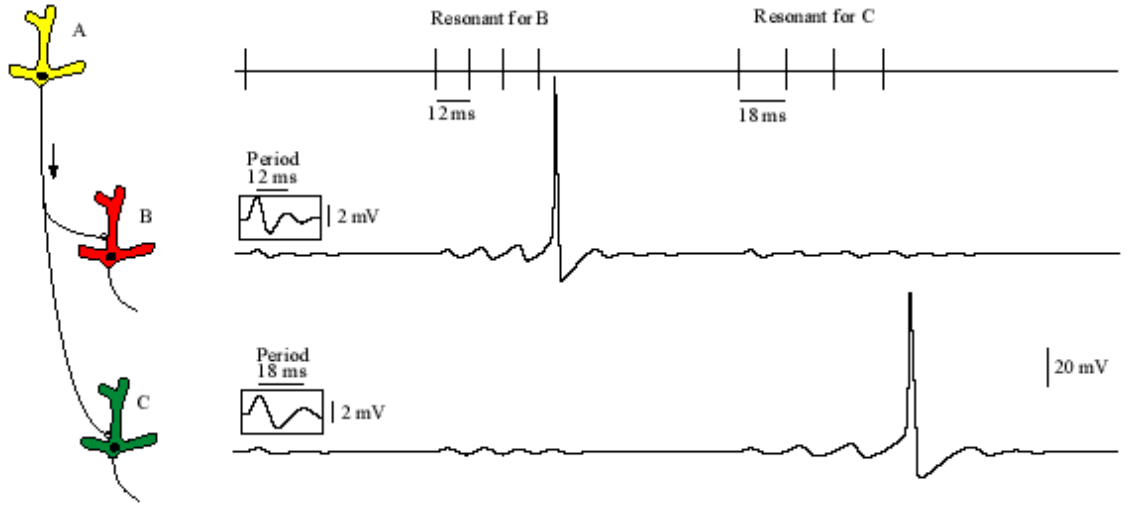
Revealing the role of bursts of action potentials is an important step toward understanding the neuronal coding. The dominant point of view is that bursts are needed to increase the reliability of communication between neurons.

Here we present an alternative but complementary hypothesis. We consider the effect a short burst on a model postsynaptic cell having damped oscillation of its membrane potential. The oscillation frequency (eigenfrequency) plays a crucial role. Due to the subthreshold membrane resonance and frequency preference, the responses of such a cell are amplified when the intra-burst frequency equals the cell's eigenfrequency. Responses are negligible, however, if the intra-burst frequency is twice the eigenfrequency. Thus, the same burst could be effective for one cell and ineffective for another depending on their eigenfrequencies. This theoretical observation suggests that, in addition to coping with unreliable synapses, bursts of action potentials may provide effective mechanisms for selective communication between neurons.



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References

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