Cable Type Model and its Application on Action Potential Propagation in a Myelinated Axon

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Abstract

A cable-type model for simulating the action potential propagation along a myelinated axon is studied. Compared with the previous works done (Moore. et al., 1978; FitzHugh, R. , 1962; Goldman, L., Albus, J. S. , 1968), spectral method is used rather than finite difference method and provides better numerical stability; Furthermore, an interpretation of the modeling on Ranvier nodes first given by FitzHugh, R. (1962) is suggested and the effect of the corresponding parameter on Ranvier node length is examined, which was ignored in Carpio, A., Peral, I. (2011), therein the author considered the nodes being modeled as points without length. Moreover, the simulation results are firstly obtained to fit the experimental data on frog in Huxley, A.F., Stampfli, R. (1949), and secondly tested by adjusting the anatomical parameters of the axon and found to be in accordance with a recent research on auditory brainstem axons (Ford, M. C. et al., 2015), where the authors used a more complicated two-cable distributedparameter model to include the more detailed anatomical parameters.