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Variations of neuronal parameters that do not change network output

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Neuronal network modeling and experiments indicate that the same physiologically relevant patterns of the network activity can be observed for quite different sets of neuronal parameters. These findings imply that parameters, each of which affects network functionality, co-vary in real networks; i.e. the variations of these parameters must be concordant. Finding such concordant variations can advance our understanding on how the properties of individual neurons determine network functionality. In particular, they may explain variability of neuronal parameters observed in living systems, and show possible paths for homeostatic regulation.

In this study, we sought local interrelations between neuronal parameters that did not change network output by using the implicit function theorem. This theorem, under certain conditions, establishes the existence and uniqueness of such interrelations, and specifies them in linear approximation. By assessing such interrelations at different points in the parameter space of a model of the leech heartbeat central pattern generator (CPG) [1], we found a linear correlation between neuronal parameters that preserve a primary output characteristic of this CPG, the cycle period. The correlated parameters were the maximal conductance of the spike-mediated synaptic current, and of the hyper-polarization activated inward current, I_h. We also found that this linear correlation was different for model neurons with different endogenous activity: silence, bursting or tonic spiking. For neurons of one type, however, the correlation was similar.

References

1. Hill AA, Lu J, Masino MA, Olsen OH, Calabrese RL: **A model of a segmental oscillator in the leech heartbeat neuronal network.** *J Comput Neurosci* 2001, **10:**281-302.