Review of: "Depolarization block of interneurons"

Katsuhiko Hata[1]

1 Kokushikan University

Potential competing interests: No potential competing interests to declare.

The authors describe the mathematical modeling of the behavior of specific neurons (interneurons) in the brain. In particular, they investigate how large currents can cause a ' depolarization block' in neurons. Synaptic currents were modeled in two different ways (deterministic and stochastic models). The results confirm that large currents result in a depolarization block' in the neuron. However, it was also shown that neural activity resumes when excitatory and inhibitory synaptic currents are within a specific range. These results indicate that inhibitory synaptic currents may reactivate neurons deactivated by depolarization block. Although the authors' study is significant, the manuscript would be improved by clarifying the following points.

1. Given the relationship between I_{ext} and I_{syn} in Equation 1 and from Figure 2, are the results in Figures 3 and 4 trivial? Given the equation $I_{syn}(V,s)=\bar{g}_{syn} \ s \ (V-E_{syn})$, it can be assumed that as \bar{g}_{syn} increases, I_{syn} also increases. With an increase in \bar{g}_{syn}, $I_{ext}-I_{syn}$ in Equation 1 is considered to decrease, leading to the results in Figures 3 and 4. This is evident from Fig. 2 is almost symmetrical with Fig. 3. For example, the case of I_{ext}=5 in Fig. 3 corresponds to the graph in Fig. 2, which proceeds from I_{ext}=5 towards 0. Similarly, the case of I_{ext} = 45 in Fig. 3 corresponds to the graph moving from I_{ext} = 45 to 0 in Fig. 2.

2. Fig. 3 and Fig. 4 indeed appear qualitatively similar, as the author stated. However, there are some differences: it would be helpful if you could discuss why the stochastic case shows a slower decrease for Iext>=25.

3. You elucidated the effect of inhibitory synaptic currents on neural activity. In equation $I_{syn}(V,s)=\bar{g}_{syn} \ s \ (V-E_{syn})$, should you also consider the influence? In that case, α, β and the function F need to be varied. If the authors think it is not necessary to consider the influence of s, please state why.

4. Please give all equations an equation number.