P1.04.

Membrane potential reconstruction, based on extracellular potential measurements

Somogyvári, Z.[1*]; Wittner, L.[2]; Ulbert, I.[2]; Érdi, P.[1, 3]

1: KFKI Research Institute for Particle and Nuclear Physics of the Hungarian Academy of Science,
2: Institute for Psychology of the Hungarian Academy of Science,
3: Center for Complex System Studies, Kalamazoo College, MI, USA

Is it possible to reconstruct the membrane potential based on extracellular (EC) potential measurements? We have developed a three-step model based method to reach this aim and showed the existence of this possibility in simulated data. In the first step, the spike CSD (sCSD) method was used to reconstruct the spatio-temporal distribution of the single cell current source density from the EC potential patterns. We have shown, that the CSD calculated from the EC potential, does not correspond to the total membrane current. Thus, we have introduced a second step of the analysis, a model-based spatio-temporal deconvolution to reconstruct the spatio-temporal distribution of the net membrane current from the CSD distribution. Finally, the membrane potential was reconstructed by using a current-based compartmental model. The procedure depends on the appropriate modeling of the morphological and passive cable properties of the neuron. Finally, we have tested the new method by comparing the results of simultaneous intracellular recordings to the reconstructed membrane potential based on EC potential recordings with micro electrode array.