

High-Intensity, Short-Duration Electric Pulses Induced Action Potential in Animal Nerves

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Abstract : The use of high-intensity, short-duration electric pulses is a promising development with many biomedical applications. The uses include irreversible electroporation for killing abnormal cells, reversible poration for drug and gene delivery, neuromuscular manipulation, and the shrinkage of tumors, etc. High intensity, short-duration electric pulses result in the creation of high-density, nanometer-sized pores in the cellular membrane. This electroporation amounts to localized modulation of the transverse membrane conductance, and effectively provides a voltage shunt. The electrically controlled changes in the trans-membrane conductivity could be used to affect neural traffic and action potential propagation. A rat was taken as the representative example in this research. The simulation study shows the pathway from the sensorimotor cortex down to the spinal motoneurons, and effector muscles could be reversibly blocked by using high-intensity, short-duration electrical pulses. Also, actual experimental observations were compared against simulation predictions.

Keywords : action potential, electroporation, high-intensity, short-duration

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