A stochastic model of the mammalian node of Ranvier has been developed to calculate thresholds for different interstimulus intervals (ISIs) (Rubinstein, 1995). The model includes 1400 voltage-gated sodium channels. The relative spread of threshold (RS) (Verrillo, 1962) calculated from this model was about 0.05 for ISIs between 0.45 and 6 ms for cathodal stimuli. For an ISI of 0.7 ms, the RS was 20 dB greater than that for other ISIs. Although it is not fully understood how the growth function of electrically evoked compound action potential (EAP) is related to single fiber characteristics, the single fiber RS is a likely contributor. We observed ISI-related changes in slope of EAP growth functions consistent with RS values predicted by the model.

Rubinstein et al. (1994) obtained EAP measures from humans in response to pulse trains. For a range of pulse rates, their data showed a fluctuating pattern of response. We have used another stochastic, biophysical model of a fiber population that includes 24 nodes of Ranvier (Rubinstein, ARO 1995) and EAP measures from animals to examine these patterns. For a 1 ms ISI pulse train stimulus, a fluctuating pattern was observed with the computational model. EAP data showed a similar fluctuating pattern, but details of the response varied with stimulus polarity and waveform.

Supported by the San Diego Supercomputer Center, Iowa Lions Club, Whitaker Foundation, and NIH.
Author/s:
Bruce, I.; Irlicht, L. S.; White, M.; O'Leary, S. J.; Dynes, S.; Javel, E.; Clark, Graeme M.

Title:
A stochastic model of the electrically stimulated nerve designed for the analysis of large-scale population [Abstract]

Date:
1997

Citation:

Persistent Link:
http://hdl.handle.net/11343/26967

File Description:
A stochastic model of the electrically stimulated nerve designed for the analysis of large-scale population [Abstract]

Terms and Conditions:
Terms and Conditions: Copyright in works deposited in Minerva Access is retained by the copyright owner. The work may not be altered without permission from the copyright owner. Readers may only download, print and save electronic copies of whole works for their own personal non-commercial use. Any use that exceeds these limits requires permission from the copyright owner. Attribution is essential when quoting or paraphrasing from these works.