

**van Zandwijk, Jan Peter; Bobbert, Maarten F.; Baan, Guus C.; Huijing, Peter A.**  
**From twitch to tetanus: Performance of excitation dynamics optimized for a twitch in predicting tetanic muscle forces.** (English) [Zbl 0862.92011](#)  
Biol. Cybern. 75, No. 5, 409-417 (1996).

Summary: In models of the excitation of muscles it is often assumed that excitation during a tetanic contraction can be obtained by the linear summation of responses to individual stimuli from which the active state of the muscle is calculated. The purpose of this study was to investigate whether such a model adequately describes the process of excitation of muscle.

Parameters describing the contraction dynamics of the muscle model used were derived from physiological and morphological measurements made on the gastrocnemius medialis muscle of three adult Wistar rats. Parameters pertaining to the excitation dynamics were optimized such that the muscle model correctly predicted force histories recorded during an isometric twitch. When a relationship between intracellular calcium and active state from literature on rat muscle was used, the muscle model was capable of generating force histories at stimulation frequencies of 20, 40, 60 and 80 Hz and other muscle-tendon complex lengths which closely matched those measured experimentally – albeit forces were underestimated slightly in all cases. Differences in responses to higher stimulation frequencies between animals could be traced back to differences in twitch dynamics between the animals and adequate predictions of muscle forces were obtained for all animals. These results suggest that the linear summation of responses to individual stimuli indeed gives an adequate description of the excitation of muscle.

**MSC:**

[92C30](#) Physiology (general)

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excitation of muscles; tetanic contraction; gastrocnemius medialis muscle; intracellular calcium; stimulation frequencies

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