

Effect of Vesicular Glutamate Deficiency on Stretch Sensitivity in Mice

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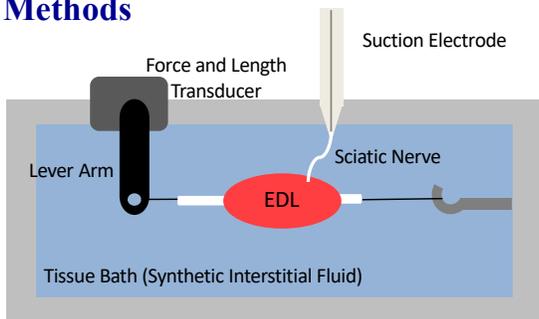
Introduction

- Proprioception is the body's ability to sense its relative position in space¹.
- Muscle spindle afferents (MSAs) are important proprioceptors and deficits in MSAs can cause issues with body movement coordination and balance².
- Glutamate is released from synaptic-like vesicles located at the MSA nerve endings when a muscle stretch occurs.
- Prior studies have suggested that glutamate release leads to increased sensitivity to stretch. The effect of glutamate on individual MSAs is unknown³.

Research Questions and Project Activities

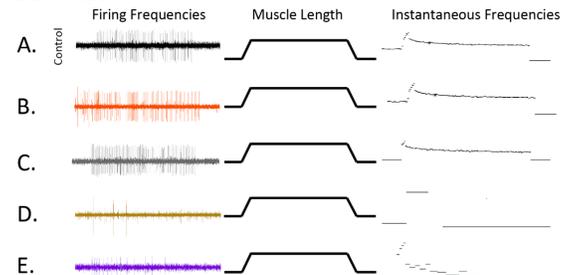
- This project looks to reveal more information about the role of glutamate in stretch sensitivity within muscles. Specifically, how does glutamate affect the firing rates of individual MSAs?
- We hypothesize that we will see lower firing rates in transgenic mice that lack the ability to release glutamate due to the reduction in vesicular glutamate transporter 1 (VGLUT1).

Methods

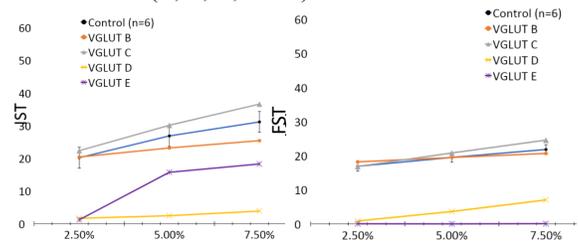


- *In vitro* preparation of the extensor digitorum longus (EDL) muscle and the deep peroneal branch of the sciatic nerve.
- Record sensory activity of stretch-sensitive MSAs through suction electrode with extracellular amplifier.
- Muscle undergoes a series of stretches and vibrations using a force and length transducer.

Results



- MSA firing of five mice: Control (A) and VGLUT1 deficient (B, C, D, and E).



- Two VGLUT1 deficient mice exhibited initial and final static time firing rates similar to the control, while the other two exhibited decreased firing frequencies.

Findings

- Results so far have been variable – half of the transgenic mice exhibited normal stretch response while the other half exhibited decreased MSA firing rates.
- Future experiments will be carried out to expand sample size of VGLUT1 deficient data.

Citations

1. Proske, U. & Gandevia, S. C. The Proprioceptive Senses: Their Roles in Signaling Body Shape, Body Position and Movement, and Muscle Force. *Physiol. Rev.* 92, 1651–1697 (2012).
2. Franco, J.A., Kloefkorn, H.E., Hochman, S., & Wilkinson, K.A. An *In Vitro* Adult Mouse Muscle-nerve Preparation for Studying the Firing Properties of Muscle Afferents. *J. Vis. Exp.* 91 (2014).
3. Bewick, G. S., Reid, B., Richardson, C., & Banks, R. W. Autogenic modulation of mechanoreceptor excitability by glutamate release from synaptic-like vesicles: evidence from the rat muscle spindle primary sensory ending. *J. Physiol.* 562, 381–394 (2005).