Age-dependent effects of capsaicin and menthol on the mammalian spinal CPG locomotor network

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This project examines the relationship between thermosensation and early development in the mammalian locomotor network. The maturation of thermosensation neural networks during early development is not well understood. We used the drugs capsaicin and menthol in our experiments. Capsaicin was used to simulate the hot temperature receptor TRPV1. It mimics the effects of noxious heat (>43˚C) and results in increased excitability of lumbar motor networks through excitatory glutamatergic mechanisms in the CPGs. Menthol was used to simulate the cool temperature receptor TRPM8. It mimics the effects of cool temperatures (15-27˚), resulting in decreased excitability of lumbar motor networks through inhibitory glutamatergic mechanisms in the CPG. Extracellular recordings were made from ventral roots from postnatal 0-5 mouse lumbar spinal cords. Locomotor activity was induced through the application of serotonin and NMDA. Capsaicin or menthol were then applied to the bath, followed by a wash. Results were grouped by age ranging from P0-P5.

We hypothesized that a bath application of capsaicin to neonatal mouse spinal cords will result in the greatest increase in CPG excitability and motor neuron recruitment for the younger age groups compared to the older groups, resulting in decreased burst duration, decreased cycle period, and increased burst amplitude. In addition, we suspected that younger age groups would have the greatest decrease in CPG excitability and motor neuron recruitment in comparison to older age groups, resulting in increased burst duration, increased cycle period, and decreased burst amplitude.

The results indicated the greatest increase in CPG excitability in youngest pups (P0-P1), resulting in decreased burst duration and cycle period. In addition, we found that older age groups tended to have little difference or a slight increase in amplitude, burst duration, and cycle period after capsaicin application (Fig.1). These results could be associated with the pruning of TRPV1 channels. The results of menthol application indicated that all ages showed depressive effects of menthol. The greatest decrease in CPG excitability was found in the oldest pups. In addition, the oldest pups had greater decrease in amplitude, indicating decreased recruitment of motor neurons (Fig.2). These results can be associated with the upregulation of TRPM8 channels.

In the future, we are hoping to increase the sample size in each category to test for significance. In addition, we are planning on varying drug concentrations and doing experiments with semi-intact preps to examine how peripheral external environmental changes will affect the CPG network. A better insight into the development of thermosensation networks during infancy can aid in the understanding of the pathology of various diseases such as sudden infant death syndrome (SIDS).

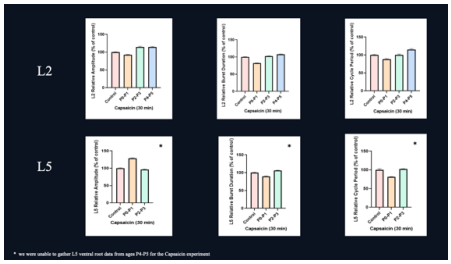
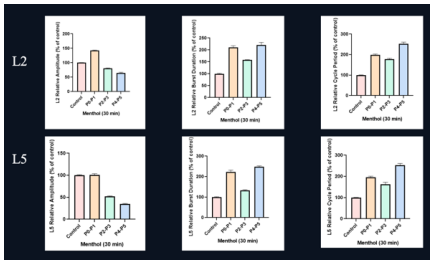
Figure 1 

Figure 2 

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