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

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This project examines the relationship between thermos-sensation and its early development in the mammalian locomotor network. The maturation of thermos-sensation neural networks during early development is not well understood. Therefore, mice are a great model to study early development as the first 6 days of a neonatal mouse's life are akin to the first 6 months of a human's life. In locomotor networks, there are central pattern generators (CPGs) which are responsible for driving rhythmic movements such as walking. These networks can be activated using drugs, resulting in locomotor-like activity, or fictive locomotion (Acevedo et al. 2016).

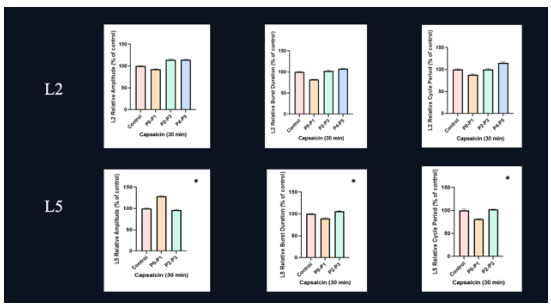
In order to see how thermoregulation develops with age, we applied capsaicin and menthol on the spinal cords of neonatal mice to simulate hot and cold temperatures through the stimulation of TRPV1 and TRPM8 channels. Capsaicin-induced activation of TRPV1 receptors mimic the effects of noxious heat (>43˚C), and menthol-induced activation of TRPM8 receptors mimic the effects of cool temperatures (15-27˚C). Previous literature suggests that the bath application of capsaicin will result in an excitatory effect of the locomotor networks, while menthol will result in a depressive one (Mandani et al., 2009).

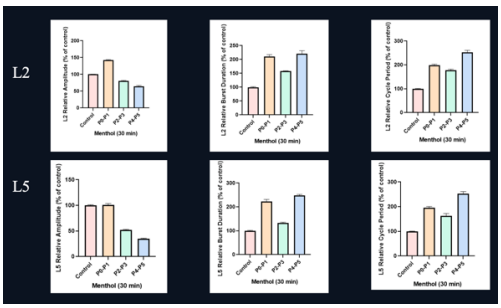
In our experiments, spinal locomotor activity was induced through the application of serotonin and NMDA. Capsaicin or menthol were then applied to the bath, followed by a wash. Using suction glass electrodes, extracellular recordings were taken from the ventral roots of postnatal 0–5 (P0-P5) mouse lumbar spinal cords. These results were then grouped by age group.

We found that capsaicin application resulted in the greatest increasing trend in CPG excitability in the youngest age group, and that these effects waned as the pups got older. These results could be associated with the pruning of TRPV1 channels as they age. As for menthol, there was the greatest increasing trend in CPG depression as the pups ages. These results could be associated with an upregulation of TRPM8 channels.

We suspect that there may be an evolutionary advantage during development for younger animals to be more resilient to the cold, but more sensitive to changes in warmer temperatures. 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).

Capsaicin results: Menthol results:





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