

## Elucidating pain-related activity in the EEG from the rat spinal nerve ligation model (SNL) of neuropathic pain

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### Abstract:

In both clinical settings and in preclinical models, specific electroencephalographic (EEG) frequencies increase during high pain states. In collaboration with the NIH HEAL Initiative Preclinical Screening Platform for Pain (PSPP) we conducted a longitudinal evaluation of the EEG for pain signatures in the spinal nerve ligation (SNL) model of pain in male and female Sprague Dawley rats for a period of 120 days following SNL surgery. Naïve, Sham and SNL rats were implanted for EEG recordings. Ligation of the L5 and L6 spinal nerves was performed as described in Kim and Chung (1992). Gait analyses and paw withhold threshold were also analyzed and reported elsewhere.

EEG recording was performed in freely behaving rats for ~22 hours and analyzed to identify quiet wake epochs using an automated wake classifier. Quiet wake epochs were detected using an in-house developed algorithm based on Recurrent Neural Networks. The algorithm was trained with rat EEG data scored by humans for 10-s epochs corresponding to resting wake periods (defined as alertness with no locomotor behavior) and removed epochs with artifact. Absolute Theta (4-8 Hz), Low gamma (30-50 Hz), and High gamma (65-100 Hz) power was extracted from wake periods using a MATLAB program written by Carl Saab and colleagues (Saab et. al, 2012, 2013). For normalization, we selected a period with stable quiet wake behavior (the first 6 h of the dark phase) and generated mean pre-SNL EEG power. To minimize inter-subject variability, each subject's post-SNL frequency power data was normalized by their corresponding pre-SNL baseline. All statistical analysis were conducted using the Linear Mixed Model with random intercepts and random slopes on *Time* nested within *Session* (day).

A significant and sustained S1 EEG theta power was observed in the female SNL group as compared to the Naïve and Sham groups. There was a transient elevation of S1 theta in female Sham rats following surgeries (D7-D21) as compared to the naïve controls. A trend for an elevated theta power in PFC in the males failed to reach significance. Low and high Gamma did not show any significant changes in the SNL model. These data and any other relevant ongoing analyses will also be discussed.