

# TRADITIONAL SPINAL STIMULATION VERSUS ULTRA LOW FREQUENCY NEUROMODULATION ON THALAMIC CELL FIRING IN A NEUROPATHIC PAIN MODEL

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## 1. Introduction:

- Chronic pain is a major cause of disability.
- Thalamic neurone firing is increased in pain patients and in models of chronic pain<sup>1,2</sup>.
- We compared the effects of a novel, ultra low frequency (ULF<sup>TM</sup>) biphasic neuromodulation and traditional low-frequency spinal cord stimulation (LF-SCS) on thalamic activity in a model of neuropathic pain.

## 2. Methods:

- Induction of spinal nerve ligation (SNL) model of neuropathic pain in rats.
- Recorded spontaneous activity of cells in ventromedial posterolateral nucleus (VPL) in thalamus 4-11 days after SNL.
- ULF current applied at vertebral level T9/10.

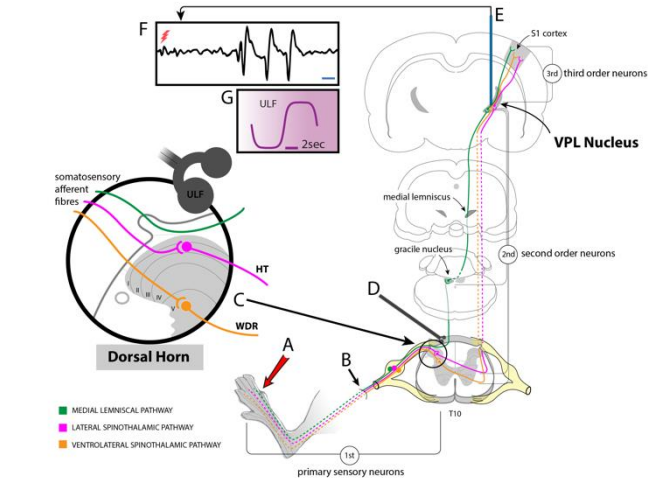


Figure 1. Representation of sensory pathways to VPL of thalamus. A: site of stim. B: site of SNL; C spinal dorsal horn; D: site of ULF; E: recording site; F: response to footshock stimulus (scale bar 2msec); G: ULF waveform

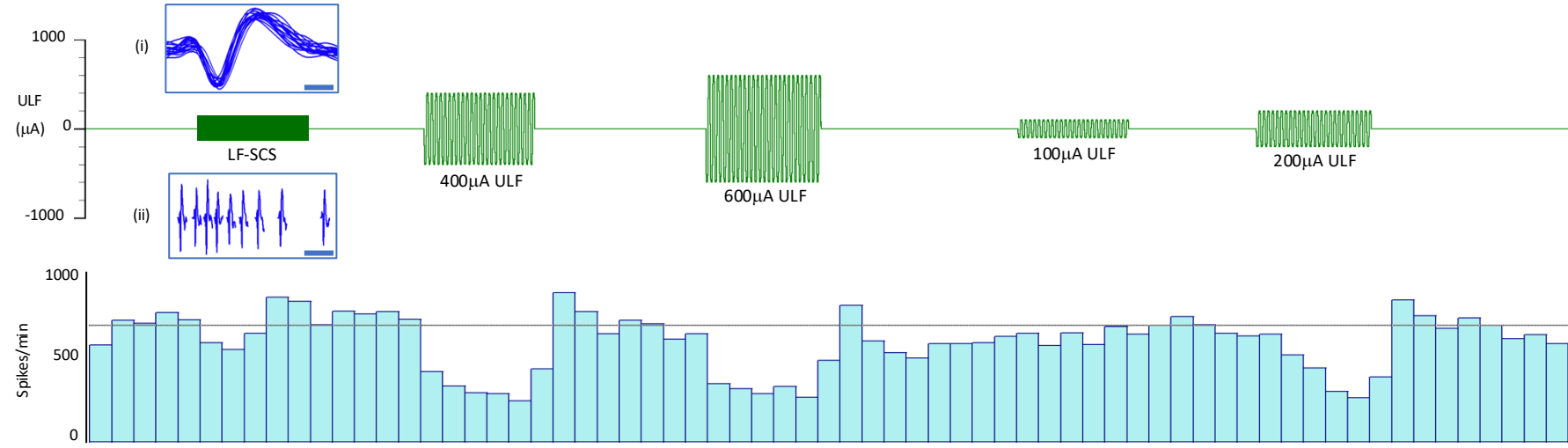


Figure 2. Firing rate of a VPL neurone unaffected by LF stimulation but dose-dependently reduced by epidural ULF current (randomized intensity). Upper: LF-SCS (70% motor threshold) and ULF-SCS; lower: firing rate in 1minute epochs (scale bar = 5min). Insets show (i) overlay of 15 spikes; (ii) a single burst of spikes (scale bars, 0.25msec and 5msec respectively).

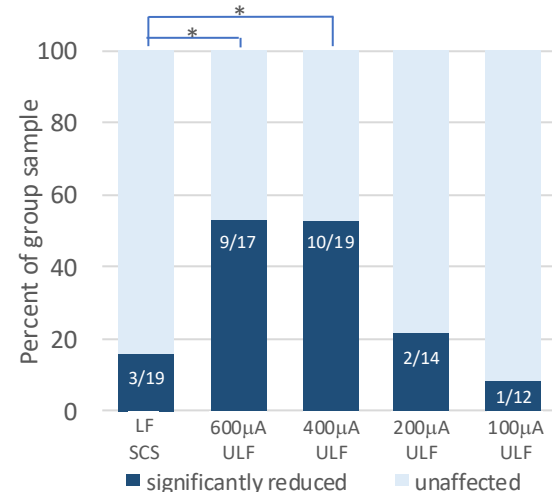


Figure 3. Numbers of cells exhibiting significant reduction in firing rate during treatment. \* $P < 0.05$ .

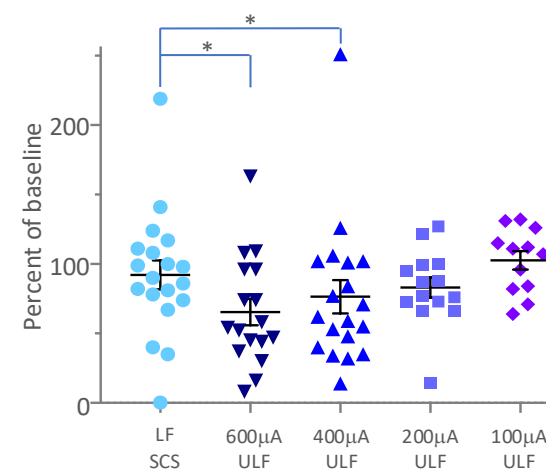


Figure 4. Thalamic Firing rate changes during treatment with LF-SCS and ULF-SCS (mean±SEM; \* $P < 0.05$ ).

## 3. Results:

- Epidurally-applied ULF current reduced the activity of VPL neurones in dose-dependent manner.
- LF-SCS was less effective in reducing VPL neurone firing.

## 4. Discussion and Conclusions:

- In this pain model, many neurones in VPL develop sustained pathological activity.
- ULF-SCS is more effective than traditional LF-SCS in reducing pain-related pathological firing of thalamic neurones.**
- The findings support previous results<sup>3,4</sup> indicating the potential for epidural ULF-SCS as a novel analgesic strategy.

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