Modulating the interoceptive network through mechanical dermal stimulation

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Research continues to show that humans are hard-wired for receiving and processing affective (slow, light) touch via unmyelinated C-Tactile Afferent neurons (CTAs). CTAs are found in all hairy skin. Information from CTAs is processed primarily in the insula, rather than the somatosensory cortex. The insula is significant for its role in processing this and other interoceptive input, and then related emotional responses. Moreover, when CTAs are stimulated through affective touch, feelings such as calm, relaxation, and social connectedness often result, all of which are also associated with improved interoceptive regulation.

Interoception is recognized as the process by which afferent signals relating to physiological states throughout the body are processed via the Central Nervous System (CNS), with multiple responses, like reacting to pain, the need to void or brush an insect off an arm. Unlike these virtually automatic responses to interoceptive input, other areas of interoceptive processing require conscious action. In these domains, there is the possibility of a mismatching between perceived and actual physiological states. This ‘dysregulated’ interoception can be seen as a characteristic of maladaptive responses to daily stressors, and in most affective disorders. Dysregulated interoception may be a mechanism underlying some sleep-related disorders and potentially represent an important area to explore for treatment.

There are many millions of individuals suffering from sleep troubles, yet there are few non-drug, low-side effect, therapeutic interventions that are effective in treating sleep-related disorders. In this tutorial, we will describe the CTA interoceptive network, discuss the relationship of that network to relaxation and sleep, and our development of a novel mechanical stimulation device, designed to target the affective touch pathway, in order to modulate that interoceptive system. Furthermore, we will describe lab and real-world testing of the technology, and lastly, discuss some implications of this novel approach to neurostimulation for future research in sleep.