

THE INTEROCEPTIVE SELF: TRANSCUTANEOUS VAGUS NERVE STIMULATION AS A NEW TOOL TO INVESTIGATE HEART-BRAIN INTERACTIONS

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Background: Interoception is the body-to-brain axis of sensations originating from the internal body organs signalling their physiological state. Neurally, these visceral signals are mainly conveyed through the vagus nerve to the Nucleus Tractus Solitarius in the brainstem from where they are relayed to regions such as the locus-coeruleus and the amygdala and, through thalamocortical projections, to higher order structures such as the insula. However, despite the recognized importance of the vagus nerve in the conduction and regulation of autonomic signals, experimental evidence of its role in bringing these signals into consciousness and in emotional processing is still lacking.

Aims: Explore the potential of non-invasive transcutaneous auricular vagus nerve stimulation (taVNS) in the modulation of interoceptive processing and in the appraisal of emotional stimuli.

Method: In a series of studies, we used single-blind within-subjects designs to compare performance during active and sham taVNS stimulation: i) in a task assessing the ability to consciously perceive heartbeats (Study 1); ii) in an experimental paradigm designed to measure the impact of cardiac afferent signals in emotional processing (Study 2); in an auditory oddball task, known to rely on the locus coeruleus-noradrenaline system, to show the effectiveness of a novel rapid event-related stimulation protocol (Study 3).

Results: In Study 1, we found improved interoceptive accuracy during active taVNS compared to sham stimulation. Study 2 showed that taVNS modulates the impact of afferent cardiac signals in the processing threat cues. In Study 3, taVNS modulated performance and pupil dilation during an auditory oddball task, providing a proof-of-principle on the effectiveness of a novel rapid event-related stimulation protocol.

Conclusions: Together, these findings enhance our understanding of the mechanisms underlying interoceptive and salience processing, and demonstrate the potential of taVNS as an important tool to investigate brain-body interactions.

Keywords: Transcutaneous vagus nerve stimulation, Interoception, Emotion, Noradrenaline

Publications:

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