# Tonic electrical stimulation of the locus coeruleus enhances cortical sensory-evoked responses via noradrenaline α1 and β receptors

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**Abstract**

The locus coeruleus (LC) neurons send extensive projections to the somatosensory cortex and release noradrenaline (NA) at synaptic terminals, which is thought to regulate the activation of sensory-related cells by acting on three types of receptors (α1, α2 and β). Although previous studies have examined the effects of LC stimulation on single-unit sensory neurons, their impact on somatosensory evoked potentials (SEPs) and their temporal variations, as well as the specific roles of NA receptors remain unclear. Herein, we investigated how SEPs are modulated by tonic LC stimulation at physiological frequencies (0.1, 1 and 4 Hz) and identified the receptors involved in these changes. Forepaw stimulation-induced amplitudes in SEP were enhanced in response to 1 Hz stimulation of the LC but not in response to 0.1 and 4 Hz stimulation. Interestingly, the enhancement of SEPs after LC stimulation persisted for tens of minutes following the cessation of stimulation. Optical imaging using a voltage-sensitive dye showed an increase in the depolarizing response in the somatosensory cortex after 1 Hz stimulation. Prazosin (α1 receptor antagonist) and propranolol (β receptor antagonist) inhibited SEP enhancement following 1 Hz LC stimulation, whereas yohimbine (α2 receptor antagonist) had no effect. This suggests that the observed enhancement in SEP observed is primarily mediated by the activation of cortical excitatory α1 and β receptors. These findings provide insight into the impact of the NA system on sensory information processing as well as the pathophysiology of sensory disorders related to the disruption of the NA system.

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