

Neural mechanisms underlying somatic tinnitus

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Somatic tinnitus patients can modulate both the intensity and pitch of their tinnitus by manipulating facial regions including their jaws and teeth, areas innervated by the trigeminal nerve. Over the past several years, we have demonstrated functional connections between the trigeminal system and the auditory brainstem and mid-brain. Stimulation of trigeminal neurons can produce changes in the spontaneous and sound driven firing *rates* of cochlear nucleus (CN) and inferior colliculus (IC) neurons. These changes in firing rate could account for the *intensity* changes in their tinnitus perceived by patients. New data indicate that trigeminal neurons can also modify the *temporal* patterns of spontaneous and sound driven responses of both CN and IC neurons, making the firing patterns more regular. Regular firing of neurons in the CN has been proposed as a model for pitch perception. Thus, if trigeminal neurons can change the *regularity* of auditory neurons' firing patterns, they could alter the perceived pitch generated by those firing patterns. The first part of the grant will examine the changes in temporal responses of CN - projection and IC - receiving neurons after stimulating regions of the face that receive trigeminal innervation. The second part of the study will examine the hypothesis that, after sound over-exposure, there will be compensatory increases in trigeminal innervation of the CN and inferior colliculus (IC). These compensatory changes will result in *enhanced* effects of trigeminal stimulation on the firing patterns in CN and IC, as exhibited by lower thresholds and latencies, longer durations and increased regularity of neural firing. In all studies involving sound over exposure, the guinea pigs will be screened for tinnitus using an increase in spontaneous rate as an indication of the presence of tinnitus as well as behaviourally assessing the animals using a novel screening technique. Understanding how somatic tinnitus occurs will help us to understand how tinnitus itself is generated. Only then can we hope to develop methods to alleviate this distressing condition.

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