# Area deep within the brain found to play role in sensory perception

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The ventrolateral nucleus (VL) of the thalamus is connected to the cerebellum and motor cortex and therefore thought to be involved in motor function. A new study to be published in *Annals of Neurology*, the official journal of the American Neurological Association, found that the VL also plays a role in sensory processing and that damage to this area leads to functional and neural changes.

Investigations of the human VL have been limited to date, due to a lack of tools available to examine its function and the fact that lesions that occur in this region tend to be larger and therefore affect more than one nucleus of the thalamus. Thalamic nuclei are dense clumps of nerve cells found where the fibers from sensory systems terminate in the thalamus.

Led by Tony Ro, of Rice University in Houston, TX, researchers conducted a series of behavioral and neuroimaging studies on a patient who had suffered a stroke affecting only the right VL, a rare occurrence. She had reported changes to her sensory abilities, such as bumping into the left sides of doorways or veering right when driving as a result of decreased sensations on the affected (left) side, but was otherwise normal. The patient was tested using visual and tactile stimuli and also underwent diffusion tensor imaging (DTI) scans, an imaging method that uses a magnetic resonance imaging (MRI) scanner to visualize the neuron fibers and connectivity in the brain. Experiments were conducted one, three and six years following the patient's stroke.

In the years following her stroke, the patient experienced a dramatic

change in her sensory perception: when she heard certain sounds, she felt tingling and other sensations in the left side of her body, especially her left arm. The results suggest that the VL lesion resulted in a significant amount of functional and neural reorganization that influenced sensory perception. For the first year and a half after her stroke, the patient demonstrated what is termed anti-extinction, in which she detected sensations significantly more on the impacted side when she was also stimulated on the unaffected side. The authors speculate that this may have reflected the initial stages of reorganization taking place in her brain. At that time, she also developed tactile sensations induced by sound, (sound-touch synesthesia), which may have been due to even further weakened pathways between the thalamus and cortex, a finding which was also suggested by the DTI results.

The synesthesia persisted, and was still present six years following her stroke. “Regardless of the exact neural mechanisms, this phenomenon of brain-damage induced feelings of sound suggests that other forms of synesthesia, in which reportedly neurologically normal individuals feel, taste or see something qualitatively different than the actual sensory input, may be due to cross-wiring in the brain, especially subcortically,” the authors suggest. The results support previous studies suggesting that acquired forms of synesthesia may appear after months or years following brain damage.

The authors note that in addition to demonstrating a previously unknown role for the VL in sensory processing, the results suggest that connections between the thalamus and other brain areas may be important for the ability of the nervous system to change in terms of sensory processing following brain damage. “Our results suggest that local disruption of the thalamus causes large-scaled changes in remotely connected regions of the brain, perhaps including excitatory connections between auditory and somatosensory cortex leading to the patient’s synesthesia,” they state.

They add that the synesthesia may also have been caused by altered connections within the thalamus that help the processing of sensory information from the body to the brain when normal processing is impaired. The authors conclude that this case study "provides tremendous insight into the consequences of VL thalamic brain damage" and in the future plan to use other behavioral and neuroimaging methods to shed light on this phenomenon.

The journal is available online via Wiley InterScience at http://www.interscience.wiley.com/journal/ana.

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