The non-classical pathway: Too great to be ignored

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The non-classical pathway: Too great to be ignored

By Frank Musiek, PhD, Angeli Mohanani, Erin Wierzbinski, Gloria Kilgore, Jacob Hunter, and Jamie Marotto

Sensory information, whether auditory or tactile, ascends to cortical centers by the classical or the non-classical pathway. Although audiologists are aware of the route sound takes to be perceived and understood, many have not even heard of the non-classical pathway. Studies from the 1970s first defined the structures of this pathway, but little is known about its anatomy and physiology other than the non-classical system ascends parallel to the classical ascending auditory system.

The classical ascending pathway starts from the cochlear nucleus, to the superior olivary complex, through the relay pathway of the lateral lemniscus, and then to the inferior colliculus and medial geniculate body. Sound reaches its destination in the auditory cortex located in the temporal lobe.

The anatomy of the non-classical ascending pathway is considered to be diffused, and it receives input from many systems besides the auditory one. Experts speculate that the information traveling through the non-classical pathway projects from the external nucleus of the inferior colliculus through the reticular formation into the dorsal and medial thalamus and various parietal association cortices. Sound bypasses the primary cortices, in this case, the auditory cortex.

Subcortical connections to limbic structures also exist, particularly in the amygdala, the part of the limbic system responsible for emotional learning, touch perception, and other primitive behaviors. The dorsal thalamus provides direct connections into the amygdala, which is also called the low route. Unlike the information that travels to the primary cortices in the classical route, this information is not highly processed and is little influenced by other centers of the brain. The non-classical pathway also receives input from other sensory systems, such as the somatosensory system, by way of the dorsal column nuclei and median nerve.

THE IMPACT OF THE PATHWAY

According to Moller et al, neurons in the non-classical system (extralemniscal) respond to sounds in a less specific way than neurons in the classical system (lemniscal). They are broadly tuned and respond irregularly to sounds of different frequencies. The neurons of the lemniscal pathway only respond to auditory stimuli, not to other sensory modalities. In contrast to the lemniscal system, the extralemniscal system has connections to the somatosensory system.

Responses by the extralemniscal and lemniscal systems, called nonspecific-extra-lemniscal evoked responses (EL-ERs), can be measured by using macro electrodes. These responses can be evoked by somatosensory and visual stimuli. EL-ERs activate, integrate, and focus attention on incoming sensory stimuli, which may be important for patients with severe tinnitus and autism.

Some children with developmental disorders may have emotional learning problems caused by the brain’s inability to reduce the involvement of the non-classical pathway and the amygdala. Moller and associates hypothesized that abnormal interactions between the somatosensory and the auditory systems are present in autistic children because of the condition’s connection to the extralemniscal system. Children with autism often present with symptoms of hyperacusis—discomfort or pain from noise—and sensitivity to
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Editor: Thank you for Dr. Raymond Hull’s article, “Environmental design enhances hearing rehabilitation” in the August issue (http://bit.ly/environmentaldesign). I have been involved for a long time in advocating for improved acoustics for persons with hearing loss. I had the opportunity to work with the Acoustical Society of America and the U.S. Access Board in developing the American National Standards Institute standards for classroom acoustics.

My true interest is for older adults, though, but because I am retired, my professional activities have waned. I also enjoyed the editorial Dr. Hull wrote in the (J Rehabil Res Dev 2011; 48[5]:xxviii; http://bit.ly/HullEditorial.) as well. Thank you very much.

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IN PRAISE OF THE ISRAELI MINISTRY OF HEALTH

Editor: We were delighted to hear of the humanitarian efforts of the Starkey Hearing Foundation and the Chaim Sheba Medical Center at Tel Hashomer in Israel as reported in your July issue (http://bit.ly/Israel-PalestineMission). We must praise them for fitting more than 1,000 Palestinian children and adults with hearing devices.

The location of the mission was Khaled ben Said School in Tulkarem. The article identified that this is in Palestine, but there is no official state of Palestine. All health care is provided through the Israeli Ministry of Health. Because this was a mission of peace, we feel it is important to provide recognition to the Israeli Ministry of Health and the State of Israel, which are committed to humanitarian efforts.

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