# Research finds music training 'tunes' human auditory system

**A newly published study by Northwestern University researchers suggests that Mom was right when she insisted that you continue music lessons -- even after it was clear that a professional music career was not in your future.**

The study, which will appear in the April issue of *Nature Neuroscience*, is the first to provide concrete evidence that playing a musical instrument significantly enhances the brainstem's sensitivity to speech sounds. This finding has broad implications because it applies to sound encoding skills involved not only in music but also in language.

The findings indicate that experience with music at a young age in effect can "fine-tune" the brain's auditory system. "Increasing music experience appears to benefit all children -- whether musically exceptional or not -- in a wide range of learning activities," says Nina Kraus, director of Northwestern's Auditory Neuroscience Laboratory and senior author of the study.

"Our findings underscore the pervasive impact of musical training on neurological development. Yet music classes are often among the first to be cut when school budgets get tight. That's a mistake," says Kraus, Hugh Knowles Professor of Neurobiology and Physiology and professor of communication sciences and disorders.

"Our study is the first to ask whether enhancing the sound environment -- in this case with musical training -- will positively affect the way an individual encodes sound even at a level as basic as the brainstem," says Patrick Wong, primary author of "Musical Experience Shapes Human Brainstem Encoding of Linguistic Pitch Patterns." An old structure from an evolutionary standpoint, the brainstem once was thought to only play a passive role in auditory processing.

Using a novel experimental design, the researchers presented the Mandarin word "mi" to 20 adults as they watched a movie. Half had at least six years of musical instrument training starting before the age of 12. The other half had minimal (less than 2 years) or no musical training. All were native English speakers with no knowledge of Mandarin, a tone language.

In tone languages, a single word can differ in meaning depending on pitch patterns called "tones." For example, the Mandarin word "mi" delivered in a level tone means "to squint," in a rising tone means "to bewilder," and in a dipping (falling then rising) tone means "rice." English, on the other hand, only uses pitch to reflect intonation (as when rising pitch is used in questions).

As the subjects watched the movie, the researchers used electrophysiological methods to measure and graph the accuracy of their brainstem ability to track the three differently pitched "mi" sounds.

"Even with their attention focused on the movie and though the sounds had no linguistic or musical meaning for them, we found our musically trained subjects were far better at tracking the three different tones than the non-musicians," says Wong, director of Northwestern's Speech Research Laboratory and assistant professor of communication sciences and disorders.

The research by co-authors Wong, Kraus, Erika Skoe, Nicole Russo and Tasha Dees represents a new way of defining the relationship between the brainstem -- a lower order brain structure thought to be unchangeable and uninvolved in complex processing -- and the neocortex, a higher order brain structure associated with music, language and other complex processing.

These findings are in line with previous studies by Wong and his group suggesting that musical experience can improve one’s ability to learn tone languages in adulthood and level of musical experience plays a role in the degree of activation in the auditory cortex. Wong also is a faculty member in Northwestern’s Interdepartmental Neuroscience Program.

The findings also are consistent with studies by Kraus and her research team that have revealed anomalies in brainstem sound encoding in some children with learning disabilities which can be improved by auditory training.

"We've found that by playing music -- an action thought of as a function of the neocortex -- a person may actually be tuning the brainstem," says Kraus. "This suggests that the relationship between the brainstem and neocortex is a dynamic and reciprocal one and tells us that our basic sensory circuitry is more malleable than we previously thought."

Overall, the findings assist in unfolding new lines of inquiry. The researchers now are looking to find ways to "train" the brain to better encode sound – work that potentially has far-reaching educational and clinical implications. The study was supported by Northwestern University, grants from the National Institutes of Health and a grant from the National Science Foundation.

Source: Northwestern University