# Music lessons fine-tune the brain

Instrumental training enhances the brainstem's sensitivity to sounds

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Your mother was right.

A new study by Northwestern University researchers suggests that learning to play an instrument is good for you whether or not you have any musical talent.

"Music training can help you do all kinds of things better," said Nina Kraus, director of Northwestern's Auditory Neuroscience Laboratory and senior author of the study. "It sharpens your hearing not just for music but for speech [because] it improves the brain's ability to make sense of the information it gets from your ear."

The study, in the April issue of Nature Neuroscience, provides concrete evidence that playing a musical instrument significantly enhances the brainstem's sensitivity to speech sounds.

"Yet music classes are often among the first to be cut when school budgets get tight," Kraus said. "That's a mistake. We should give kids the opportunity to study music as part of their overall education."

Music training

Twenty adults took part in the study. Half were amateur musicians who had at least six years of continuous musical instrument training starting before age 12. (On average, the musicians had nearly 11 years of music lessons.) The other half had less than three years of music training (just over one year on average). All were native English speakers with no knowledge of Mandarin, a tone language.

In tone languages, a single syllable can differ in meaning depending on pitch patterns, or tones. "Mi" delivered in a level tone means "to squint"; in a rising tone it means "to bewilder"; and in a falling-then-rising tone it means "rice." (English, by contrast, uses pitch only for intonation, as when rising pitch is used to signify a question.)

The researchers piped the three Mandarin "mi" sounds into a subject's ear as he watched a movie and listened to its soundtrack with the other ear. Electrodes attached to his scalp measured and graphed the accuracy of his brainstem ability to track the differently pitched sounds.

Even with their attention focused on the movie, the musicians were far better at tracking the three different tones than the non-musicians, the researchers found.

The study suggests a bigger role for the brainstem, a primitive structure at the base of the brain that was believed to be unchangeable and uninvolved in complex processing such as music and language.

"The responses we measured came from the brainstem," Kraus said. "It was generally thought that this part of the brain just passes information along without changing it. But it now appears that it's trainable, that our basic sensory circuitry changes with experience.

"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. Engaging in high-level cognitive activities like music ... may help you hear speech in a noisy classroom or pick up on nuances of people's tone of voice."

The research does not prove definitively that early musical training is what leads to a sharper sensory system. Because of the design of the study, it's possible that the subjects who stuck with their childhood music lessons were born with some ability that made playing music easier or more enjoyable.

Earlier the better

But Kraus pointed out that the earlier her subjects started taking music lessons, the more accurate their pitch tracking. And the more years of musical training they had, the better their ability to distinguish pitch. Those correlations, she said, suggest that the brainstem is trainable.

"If those factors didn't matter," she added, "then one could really argue their sensory systems were different to begin with."

If the Northwestern researchers are right, Kraus said, then music training might help people learn to read better.

In earlier studies, Kraus found that some children with learning disabilities have a dysfunction in the way their brainstem encodes basic speech sounds.

"The brainstem activity that's associated with hearing certain types of sounds is subtly changed" in those children, she explained. But those anomalies in sound encoding can be improved by auditory training.

"What's deficient in those kids is related to what's enhanced with music training," Kraus said.

The latest study, supported by the National Institutes of Health and the National Science Foundation, was done in collaboration with Patrick Wong, director of Northwestern's Speech Research Laboratory.

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