Ability to listen to 2 things at once is largely inherited, says twin study

Your ability to listen to a phone message in one ear while a friend is talking into your other ear—and comprehend what both are saying—is an important communication skill that's heavily influenced by your genes, say researchers of the National Institute on Deafness and Other Communication Disorders (NIDCD), one of the National Institutes of Health. The finding, published in the August 2007 issue of *Human Genetics*, may help researchers better understand a broad and complex group of disorders—called auditory processing disorders (APDs)—in which individuals with otherwise normal hearing ability have trouble making sense of the sounds around them.

"Our auditory system doesn't end with our ears," says James F. Battey, Jr., M.D., Ph.D., director of the NIDCD. "It also includes the part of our brain that helps us interpret the sounds we hear. This is the first study to show that people vary widely in their ability to process what they hear, and these differences are due largely to heredity."

The term "auditory processing" refers to functions performed primarily by the brain that help a listener interpret sounds. Among other things, auditory processing enables us to tell the direction a sound is coming from, the timing and sequence of a sound, and whether a sound is a voice we need to listen to or background noise we should ignore. Most people don't even realize they possess these skills, much less how adept they are at them. Auditory processing skills play a role in a child's language acquisition and learning abilities, although the extent of that relationship is not well understood.

To determine if auditory processing skills are hereditary, NIDCD researchers studied identical and fraternal twins who attended a national twins festival in Twinsburg, OH, during the years 2002 through 2005. A total of 194 same-sex pairs of twins participated in the study (138 identical pairs and 56 fraternal pairs), representing ages 12 through 50. All twins received a DNA test to confirm whether they were identical or fraternal and a hearing test to make sure they had normal hearing.

If a trait is purely genetic, identical twins, who share the same DNA, will be alike nearly 100 percent of the time, while fraternal twins, who share roughly half of their DNA, will be less similar. Conversely, if a trait is primarily due to a person's environment, both identical and fraternal twins should have roughly the same degree of similarity, since most twins grow up in the same household.

The volunteers took five tests that are frequently used to identify auditory processing difficulties in children and adults. In three of the tests, volunteers listened as two different one-syllable words or nonsense syllables (short word fragments such as ba, da, and ka) were played into their right and left ears simultaneously, and then tried to name both words or syllables. In two other tests, volunteers listened to digitally altered one-syllable words played into the right ear and tried to identify the word. One test artificially filtered out high-pitched sounds, which tended to obscure the consonants, while the other sped up the word.

In all but the filtered-words test, researchers found a significantly higher correlation among identical twins than fraternal twins, indicating that differences in performance for those activities had a strong genetic component. Participants showed the widest range of abilities on those tests in which they were asked to identify competing words or nonsense syllables entering each ear—called dichotic listening ability. The tests in which different one-syllable words were played simultaneously into each ear showed the widest degree of variation as well as the highest correlation among twins, especially identical twins. As much as 73 percent of the variation in dichotic listening ability was due to genetic differences, a magnitude that is

comparable to well-known inherited traits such as type 1 diabetes and height. Conversely, the ability to understand the filtered words showed high correlation among all twins, indicating that variation in that skill is primarily due to differences in environment.

Scientists believe that problems with dichotic listening ability are often due to a lesion or disconnect between the brain's right and left hemispheres. When we listen to someone talking, speech entering the right ear travels in large part to the left side of the brain, where language is processed. Speech entering the left ear travels first to the right side of the brain before crossing to the brain's language center on the left side by way of the corpus callosum, a pathway connecting the brain's right and left hemispheres.

Today's finding that normal twins show such wide variation in their dichotic listening abilities, and that the differences are mostly due to genetic variation, adds a new perspective to our understanding of auditory processing disorders. These disorders may affect as many as seven percent of school-aged children in the United States and often appear alongside language and learning disorders, including dyslexia. APDs also affect older adults and stroke victims and can limit the successfulness of hearing aids in the treatment of hearing loss. The researchers suggest that scientists may be able to fine-tune their understanding of what an APD is and the role these disorders play in the development of language and learning disorders.

Source: NIH/National Institute on Deafness and Other Communication Disorders