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Research reveals that temporary hearing deprivation can lead to 'lazy ear'

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Hearing scientist Daniel Polley, Ph.D., an investigator at Massachusetts Eye and Ear Infirmary's Eaton-Peabody Laboratories of Auditory Physiology, has gained new insight into why a relatively short-term hearing deprivation during childhood may lead to persistent hearing deficits, long after hearing is restored to normal. The research, featured on the cover on the March 11 issue of the journal *Neuron*, reveals that, much like the visual cortex, development of the auditory cortex is quite vulnerable if it does not receive appropriate stimulation at just the right time.

It is well established that degraded sensory experience during critical periods of childhood development can have detrimental effects on the brain and behavior. In the classic example, a condition called amblyopia (also known as lazy eye) can arise when balanced visual signals are not transmitted from each eye to the brain during a critical period for visual cortex development.

"An analogous problem may exist in the realm of hearing, in that children commonly experience a buildup of viscous fluid in the middle ear cavity which can degrade the quality of acoustic signals reaching the brain, which has been associated with a long-lasting loss of auditory perceptual acuity," explains senior study author, Dr. Polley.

Dr. Polley and his colleague Dr. Maria Popescu from Vanderbilt University implemented a method to reversibly block hearing in one ear in infant, juvenile and adult rats then looked at how the parts of the brain

involved in hearing were impacted by the temporary hearing loss.

They observed that the temporary hearing loss in one ear distorted auditory patterning in the brain, weakened the deprived ear's representation and strengthened the open ear's representation. The scope of reorganization was most striking in the cortex (and not "lower" parts of the central auditory pathways) and was more pronounced when hearing deprivation began in infancy than in later life. Therefore, it appears that maladaptive plasticity in the developing auditory cortex might underlie "amblyaudio," in a similar fashion to the contributions of visual cortex plasticity to amblyopia.

"The good news about amblyaudio is that it is unlikely to be a permanent problem for most people," concludes Dr. Polley. "Even if the acoustic signal isn't corrected within the critical period, the mature auditory cortex still expresses a remarkable degree of plasticity. We know that properly designed visual training can improve visual acuity in adult amblyopia patients. We are gearing up now to study whether auditory perceptual training may also be a promising approach to accelerate recovery in individuals with unresolved auditory processing deficits stemming from childhood hearing loss."

More information: Popescu et al.: “Monaural Deprivation Disrupts Development of Binaural Selectivity in Auditory Midbrain and Cortex.” Publishing in Neuron 65, 718-731, March 11, 2010. DOI 10.1016/j.neuron.2010.02.019

Provided by Massachusetts Eye and Ear Infirmary

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