The importance of vocalizations between mice and their offspring

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A study by a research team at the Max Delbrück Center in Berlin that appears in the journal *PNAS* has found a group of neuronal cells in the

brain stem that coordinate exhalation and tension of muscles in the larynx of baby mice without which they are mute. The cries of human babies may well depend on similar connections, which could also be impaired in speech disorders.

Almost immediately after birth, mouse pups that are separated from their mother are able to make calls to summon her. The generation of these calls requires vigorous exhalation and the tensioning of laryngeal muscles, which requires the coordinated activity of two muscle groups. This is achieved by neurons in the brainstem, according to a study by Carmen Birchmeier's lab at the Max Delbrück Center for Molecular Medicine in the Helmholtz Association (MDC).

In series of experiments, the researchers have shown that the cells of the nucleus tractus solitarii (NTS) are linked to cells that control tension in the abdominal muscles, enabling vigorous exhalation, and the muscles in the larynx. The nucleus also receives sensory information from the vocal folds, the tongue and the lung. During vocalization, it coordinates sensory inputs and motor outputs. However, if the genes for the transcription factors Olig3 or Tlx3 are mutated, the nerve cells in this particular nucleus cannot mature properly in the fetus. Without it, the pups cannot vocalize after birth.

The mother ignores mute offspring

Newborn mice need proximity to their mother for survival. As soon as a newborn mouse pup escapes the safety of the nest, it emits salvos of four to six calls with a frequency of 75 kHz. These sounds are not audible to the human ear. During each call, the newborn mouse exhales deeply. The mother responds immediately, looking for her lost pup and reuniting it with the rest of the litter. Even recorded ultrasound calls will prompt her to seek her offspring. If a baby mouse in distress is unable to emit these calls, the mother cannot respond.

"We suspect that the calls are an evolutionarily conserved signal that indicates the offsprings' fitness and health," Carmen Birchmeier says. "The mute mice are also a model for investigating the importance of vocalization for the interaction between mother and baby," first author Luis Hernandez-Miranda says.

Another theory is that the functional faults in the nucleus could be involved in the development and manifestation of speech disorders, which are often seen in patients after strokes, those who have tumors or are suffering from neurodegenerative diseases.

More information: Luis Rodrigo Hernandez-Miranda et al, Genetic identification of a hindbrain nucleus essential for innate vocalization, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1702893114

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