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Identification of a gene essential to newborn babies' first breath

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How do mammals prepare themselves in utero for a radical modification to their respiration at the time of birth, when they move abruptly from an aquatic medium to air?

French researchers at CNRS have identified a gene in the mouse that is essential to respiration and consequently to survival at birth. This work, just published in the Journal of Neuroscience, opens the way to better understanding respiratory disorders in humans, which can range from sleep apnea to sudden infant death syndrome.

In mammals, the foetus develops in a liquid environment where the umbilical cord provides a supply of oxygen and pulmonary functions are almost absent. At birth, the newborn moves from intra-uterine aquatic life to independent living in an aerial environment. How does the body prepare itself for such an abrupt transition? We already know that several neuronal circuits intervene in neonatal respiration in mammals. More specifically, two regions situated in the hindbrain have been identified (the pre-Bötzinger complex and the parafacial respiratory group). These neurons are the source of a pacemaker activity, or in other words a rhythm in the brainstem that gives rise to automatic respiratory movements and thus prepares newborns for birth.

The studies performed by researchers in Paris and Marseilles reveal that a protein called TSHZ3 is present in the parafacial respiratory group and plays a major role in the activity of neurons in that region. Newborn mice in which the Tshz3 gene (which codes for the TSHZ3 protein) does

not function are unable to breathe at birth and die after a few minutes. Although in principle the pre-Bötzinger complex and parafacial respiratory group have developed correctly in these mutant newborn mice, neurons in the parafacial respiratory group do not display the rhythmic activity that is their specific characteristic. Thus a single gene, Tshz3, is capable of controlling development in the neurons of several elements and cellular events that are essential to breathing at birth.

In the future, collaborative efforts with medical research teams may provide a clearer understanding of the implication of Tshz3 in human respiratory disorders, ranging from sleep apnea to sudden infant death syndrome, which is the principal cause of neonatal deaths in Western countries.

More information: Teashirt 3 regulates development of neurons involved in both repiratory rhythm and air flow control, X. Caubit, M. Thoby-Brisson, N. Voituron, P. Filippi, M. Bévengut, H. Faralli, S. Zanella, G. Fortin, G. Hilaire, and L. Fasano. The Journal of Neuroscience, 14 juillet 2010.

Provided by CNRS

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