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Researchers observe brain development in utero

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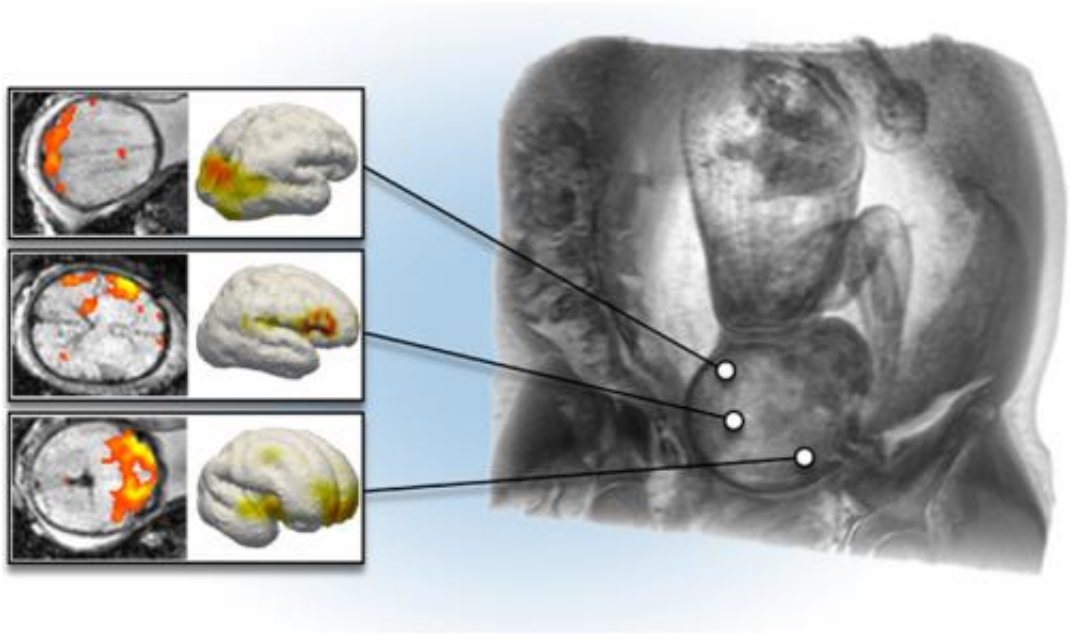

In this figure, separated bilateral occipital, unilateral temporal and bilateral frontal activations have been overlaid onto a brain model of the fetus (MRI reconstruction).

New investigation methods using functional magnetic resonance tomography (fMRT) offer insights into fetal brain development. These "in vivo" observations will uncover different stages of the brain's

development. A research group at the Computational Imaging Research Lab from the MedUni Vienna has observed that parts of the brain that are later responsible for sight are already active at this stage.

To obtain insights into the development of the human brain in utero, the study group observed 32 fetuses from the 21st to 38th week of pregnancy (an average pregnancy lasts 40 weeks). The architecture of the brain is developed particularly during the middle trimester of pregnancy. Using functional magnetic resonance tomography, it was possible to measure activity and thereby gain information about the most important cortical and sub-cortical structures of the developing brain. During the period of the 26th to 29th week of pregnancy in particular, short-range neuronal connections developed especially actively, while in contrast to this, long-range nerve connections exhibited more linear growth during pregnancy. "It became apparent that the areas responsible for sensory perception are developed first and only then, around four weeks later, do the areas responsible for more complex, cognitive skills come along," says first author Andras Jakab from the Computational Imaging Research Lab at the MedUni Vienna, explaining the results.

In another study, the study group led by Veronika Schöpf and Georg Langs was able to demonstrate for a correlation of eye movement and areas of the brain which are later responsible to process vision as early as the 30th to the 36th weeks of pregnancy. The fact that newborn babies first have to learn to "process" visual stimuli after birth is already known. It has now been possible to demonstrate that this important development starts even before birth. The research group investigated the relationship between eye movements and brain activity. Even at this stage of development, motor visual movement is linked to the areas in the visual cortex of the brain responsible for processing optical signals. "The relationship between eye movement and the responsible areas of the brain has therefore been demonstrated for the first time in utero", explains first author Veronika Schöpf.

A more detailed study at the Computational Imaging Research Lab and the Department of Neuroradiology and Musculoskeletal Radiology at the MedUni Vienna is currently working on a reference model for healthy brain development in order to be able to detect malformations and pathologies in fetuses. For this study, a grant from the Austrian National Bank was awarded (The chronological progression of development of functional and structural networks in the foetal brain, No.: 15929).

More information: "Fetal functional imaging portrays heterogeneous development of emerging human brain networks." Andras Jakab, Ernst Schwartz, Gregor Kasprian, Gerlinde M. Gruber, Daniela Prayer, Veronika Schöpf and Georg Langs. *Frontiers in Human Neuroscience* 2014; 8:852.

"The Relationship Between Eye Movement and Vision Develops Before Birth." V Schöpf, T Schlegl, A Jakab, G Kasprian, R Woitek, D Prayer, G Langs. *Frontiers in Human Neuroscience* 2014; 8 :775.

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