- Childbirth / Brain

COMMERCIAL DISTRIBUTION IS STRICTLY PROHIBITED • PRINTED FROM PRESSREADER • NOT FOR SALE • PERSONAL COPY

HEALTH

Baby brain activity changes dramatically before and after birth

WORDS EMILY COOKE



New research has shown that neuronal activity in certain brain regions increases significantly around birth

Scientists have provided unprecedented insight into how the activity of neurons in the brain changes across birth. Researchers analysed 184 brain scans collected from 140 fetuses and infants of gestational ages between 25 and 55 weeks post-conception. A typical pregnancy lasts approximately 40 weeks, so these datasets gave the researchers a good snapshot of what the brain looks like before and after birth. The scans revealed that the activity of neurons within certain regions of the brain increased significantly across birth. These regions include the sensorimotor network, which is responsible for processing external stimuli, like sights and sounds, and for coordinating movements. They also include the subcortical network, which acts like a relay hub for information from different brain regions.

After birth, babies are suddenly exposed to a huge amount of sensory input from the outside world – often the beeps of hospital equipment, the smells of their parents and lights shining down on them. Their brains have to be prepared for and able to adapt to this noisy world beyond the womb. However, until now, little was known about how brain activity actually changes across birth. Over a decade, researchers have built up a detailed dataset of scans of the brains of fetuses and infants using functional magnetic resonance imaging (fMRI). This technique indirectly measures brain activity by monitoring how much oxygenated blood is flowing through the organ, and thus is being used by neurons in different areas.

Typically, scientists conduct fMRI by having a person lie very still inside a tube-shaped scanner. However, it's hard to get a clear signal of fetuses' brain activity, especially given that they move around a lot in the womb. To overcome this challenge, the researchers scanned the brains of fetuses using a soft magnetic coil that they put directly onto their mothers' abdomens. Then they used various analytical techniques, including artificial intelligence (AI), to cancel out the effects of the fetus moving around. With that noise removed, they could reconstruct the neural activity that was unfolding in the fetuses' brains.

Besides the observed effects in the sensorimotor and subcortical networks, the researchers also noticed that brain activity significantly increased in the 'superior frontal network' across birth. This network of connected brain areas regulates more complex cognitive skills, such as working memory, which enables people to remember things in the short term, for example when they're thinking through a math problem. "The change in the superior frontal cortex is kind of beyond our expectation because we believe the frontal lobe develops later during childhood," said Lanxin Ji, a postdoctoral research fellow at NYU Langone Health.

Notably, although the researchers observed sharp, significant increases in functional connectivity across birth, the efficiency of communication between these neurons increased much more gradually. In other words, the neurons were connected with others a lot more, but an efficient network had yet to be refined. The researchers think the brain may need time to refine its network structure to optimise efficiency while removing expendable connections, a phenomenon known as synaptic pruning.

© Julia-Marlen Schiefelbein; Berlin State Office for Monument Preservation / Shutterstock