How inflammation affects brain development

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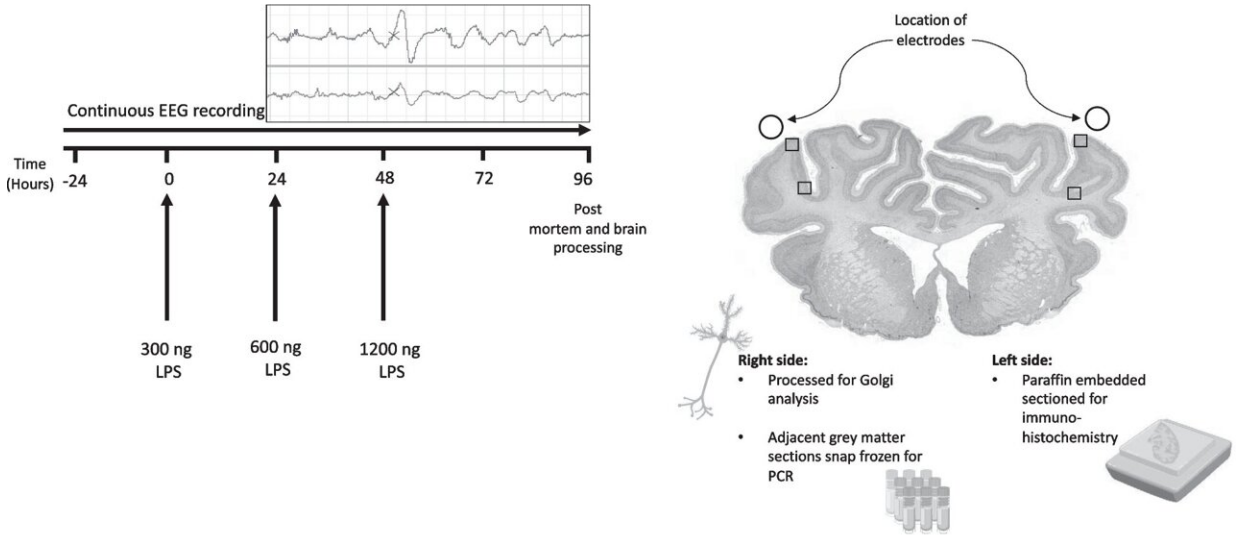


Schematic outlining the study design. The study consisted of two groups: control (vehicle, n = 9) and LPS (n = 8). The solid lines show the timing of the lipopolysaccharide (LPS)/vehicle infusions which were given over 2 min at increasing doses (300 ng, 600 ng, and 1200 ng). Controls received an equivalent volume of vehicle (saline) during the infusion period. Continuous electroencephalogram (EEG) recordings were performed throughout the experiential period. At 96 h, brains were collected for Golgi staining to examine neuronal arborisation and numbers of dendritic spines, immunohistochemistry to assess neuroinflammation, neuronal numbers and cortical area and mRNA assessment of proinflammatory proteins. Boxes indicate regions of interest used for immunohistochemical and Golgi analysis. Credit: *Journal of Neuroinflammation* (2023). DOI: 10.1186/s12974-023-02805-x

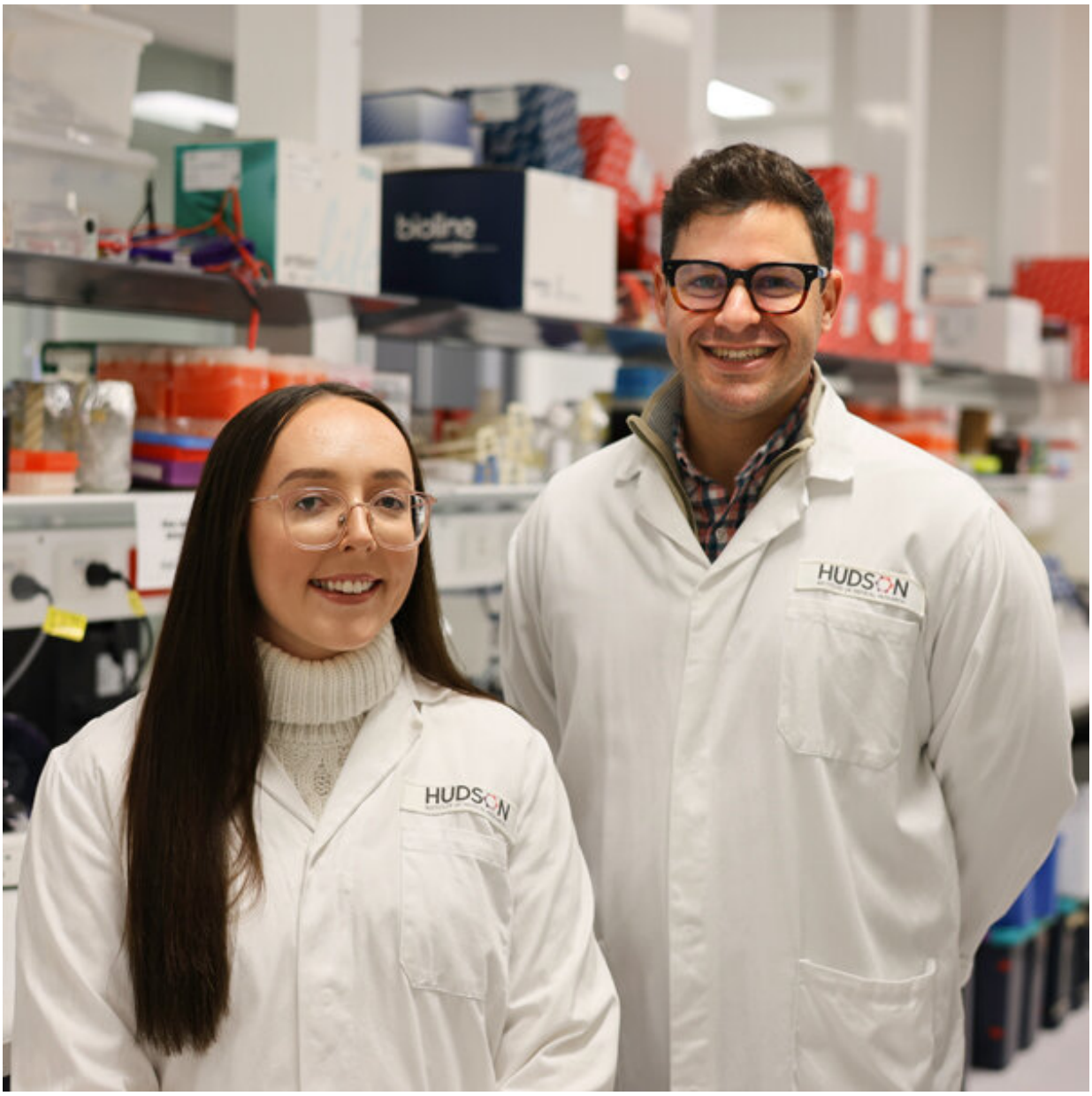
It has long been recognized that too much inflammation in the womb can harm an unborn baby's brain development, but exactly how it happens has been a mystery until now.

Dr. Rob Galinsky and his team at Hudson Institute of Medical Research focus on understanding the cellular and physiological processes that impair brain development and function in the fetus and newborn.

Their latest research, published in the *Journal of Neuroinflammation*, shows for the first time how inflammation changes nerve cell maturation and function.

They showed that too much inflammation in the womb impairs the maturation of nerve cells (called neurons), leading to reduced electric activity.

Neurons are the cells in our brain and spinal cord that receive and transmit electrical signals that control the way we walk, hear, see, and think.



L-R: Sharmony Kelly and Dr Robert Galinsky. Credit: Hudson Institute of Medical Research

Brain development impacts

Lead researcher, Sharmony Kelly says their findings will have a positive

impact in preventing or reducing a wide range of conditions that can affect babies, especially those born preterm.

"Inflammation can lead to cerebral palsy or developmental problems affecting growth, movement, vision and hearing, as well as social and emotional problems, language and cognitive delays and more," Kelly said.

"By increasing our understanding of exactly how inflammation damages brain development we hope to help prevent these life-long consequences."

"We also showed that these impairments in nerve cell maturation can be detected using a relatively simple and widely used clinical tool that measures electrical activity in the brain, called electroencephalography," said Dr. Galinsky.

Delicate balance of brain development

"By improving our understanding of the cellular mechanisms that contribute to inflammation-induced disturbances in brain development, and their functional consequences, we can improve our ability to detect neurodevelopment impairments earlier."

Sharmony Kelly likened the impact of inflammation to a disruption in the symphony of brain development.

"Imagine the brain as an orchestra playing a melody of growth and connectivity; when it's exposed to inflammation, like an out-of-tune instrument, the orchestra's performance becomes distorted."

"If the delicate balance of brain activity, cellular growth, and immune responses is disrupted, potentially leading to long-lasting consequences."

"We're drawing attention to the significance of maintaining a harmonious environment for healthy brain development and the potential consequences when that balance is disrupted," she said.

More information: Sharmony B. Kelly et al, Progressive inflammation reduces high-frequency EEG activity and cortical dendritic arborisation in late gestation fetal sheep, *Journal of Neuroinflammation* (2023). DOI: 10.1186/s12974-023-02805-x

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