Additive deleterious effects of delivery mode on perinatal brain injuries: microbiota's fault

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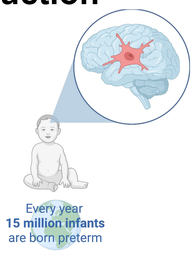
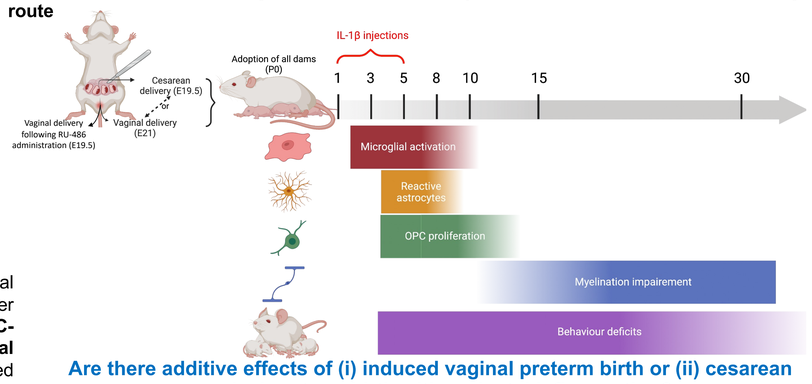
Introduction



Most cases are associated with materno-fetal **infection/inflammation**, leading to white matter injuries (WMI). Preterm infants delivered by **C-section** are at higher risk of **neurodevelopmental disorders (NDD)** compared with vaginally delivered infants.

A mouse model for brain injuries associated with preterm birth and differential delivery route

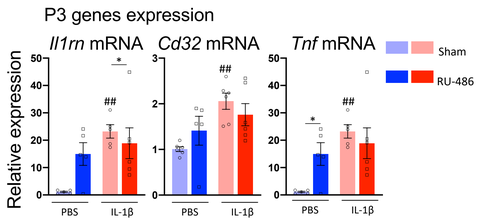


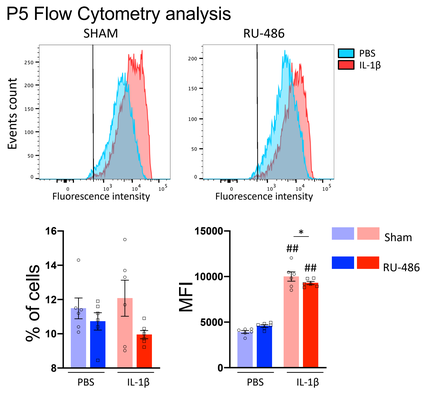
Are there additive effects of (i) induced vaginal preterm birth or (ii) cesarean surgical preterm birth with perinatal inflammation?

Mifepristone (RU-486) administration induced vaginal preterm delivery without affecting WMI *Morin et al. (2022)*

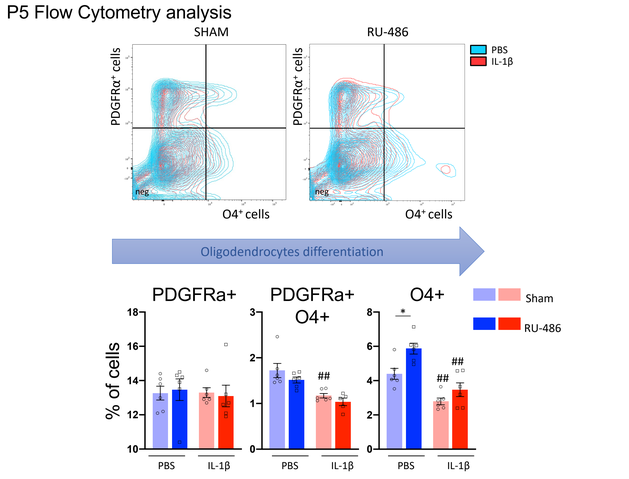
Mifepristone (RU-486) is a **glucocorticoid receptor (GR) antagonist**. As an anti- progesterone drug, RU-486 is used in pharmacological abortion, and to induce delivery rarely for living fetuses and mostly in case of *in utero* fetal death.

Microglial reactivity (CD11B+) is restrained by RU-486

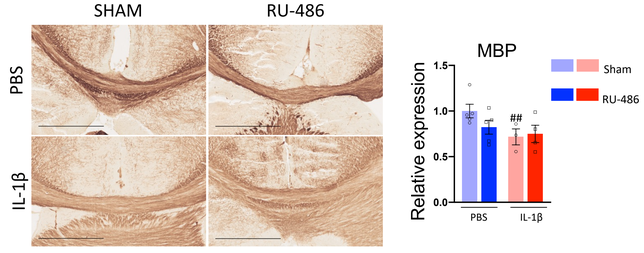




Oligodendrocytes differentiation, the first victims of perinatal inflammation, is still blocked.



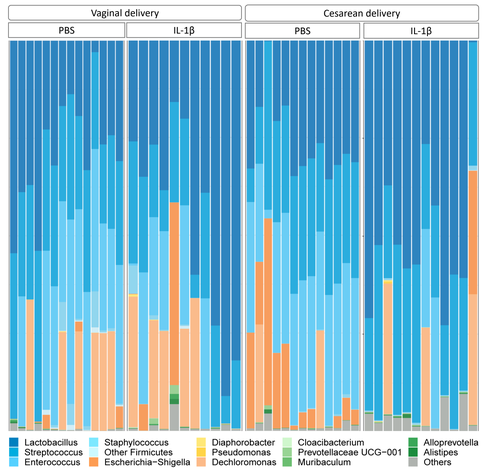
Myelination deficit of the corpus callosum is still observed

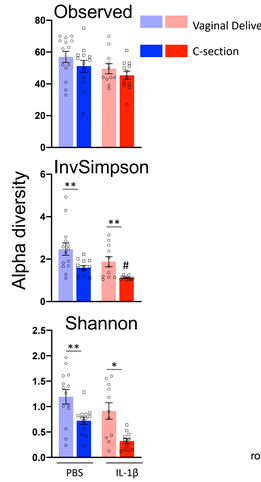


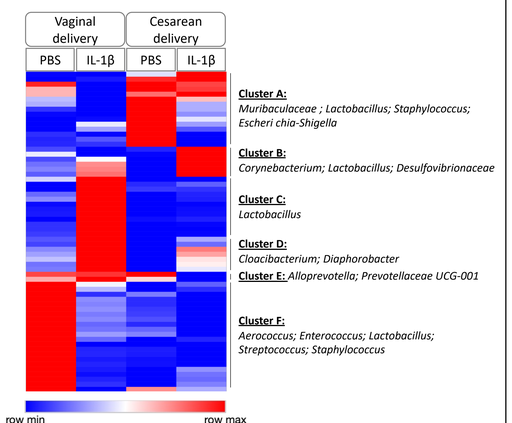
Preterm birth by cesarean delivery worsens WMI

Global **cesarean section (C-sections)** rates have increased in recent decades. Numerous studies have revealed the existence of a **"gut-brain axis"** and the impact of an alteration of gut microbiota composition in brain diseases. Many factors in early life such as the mode of delivery or preterm birth could lead to **disturbances in the assembly and maturation** of gut microbiota.

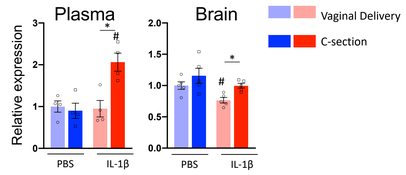
Gut Microbiota is altered by C-sections and worsen by perinatal inflammation



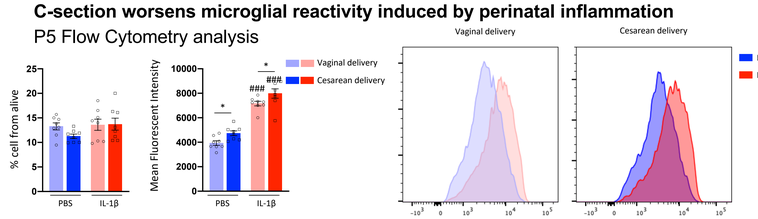




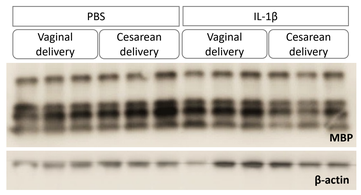
Peptidoglycan levels are impaired

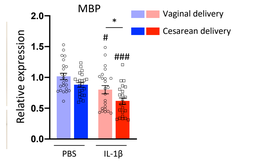


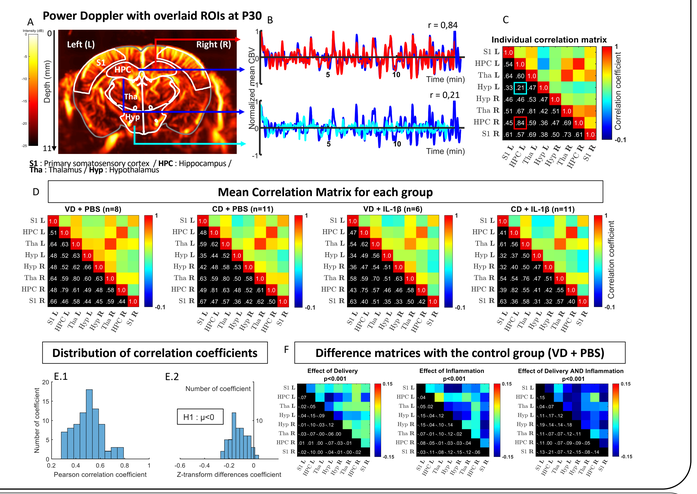
C-section worsens microglial reactivity induced by perinatal inflammation



C-section worsens hypomyelination induced by perinatal inflammation, leading to brain connectivity defects







Consistent with literature data, exposure to RU-486 (crossing the placenta) prevented microglial reactivity associated with exposure to IL-1beta. On the other hand, this is not enough to prevent hypomyelination that occurs later. Thus, early birth alone did not exacerbate the effects of inflammation. We were able to demonstrate a reduction in microbiota diversity in a C-section mouse model, which was exacerbated when the offspring were exposed to IL-1beta. This reduction was accompanied by a more pronounced neuroinflammation phenomenon mediated by microglia. The long-term consequence of the combined effects of C-section and inflammation is more pronounced PWMI, leading to deficits in functional brain connectivity associated with NDD-like behaviors.