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Impact of early experience on brain development and cognition in lambs

Elodie Chaillou

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Impact of early experience on brain development and cognition in lambs

Elodie Chaillou, PhD, UMR PRC, Tours-Nouzilly





Why investigate cognition in lambs?





Why investigate cognition in lambs?

Cognition => Cognitive processes involved in

- Perception*
- Emotion*
- Learning*
- Preferences*
- Social interactions*
- ...*





Impact of early experience on brain development and cognition in lambs

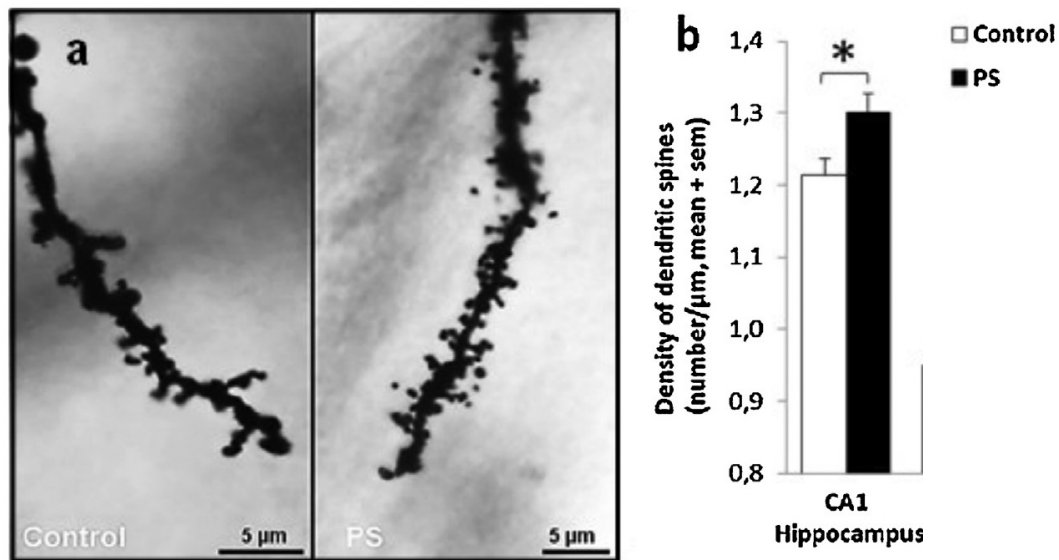
In utero
Postnatal





In utero : impact of prenatal stress

At birth



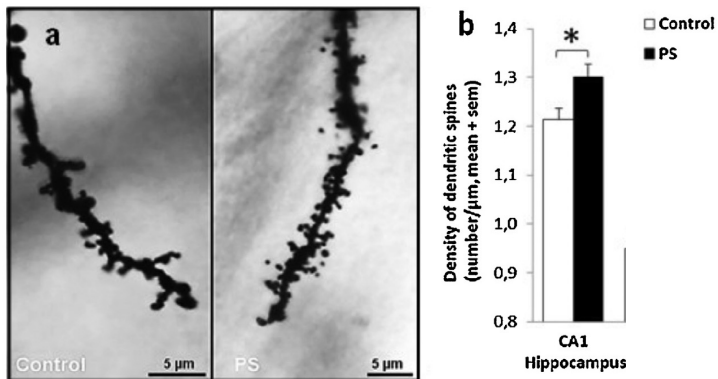
Spine density in terminal apical branches of pyramidal neurons located in CA1 hippocampus (* $p < 0.05$). Adapted from Petit et al 2015, Behavioural Brain Research 291:155-163





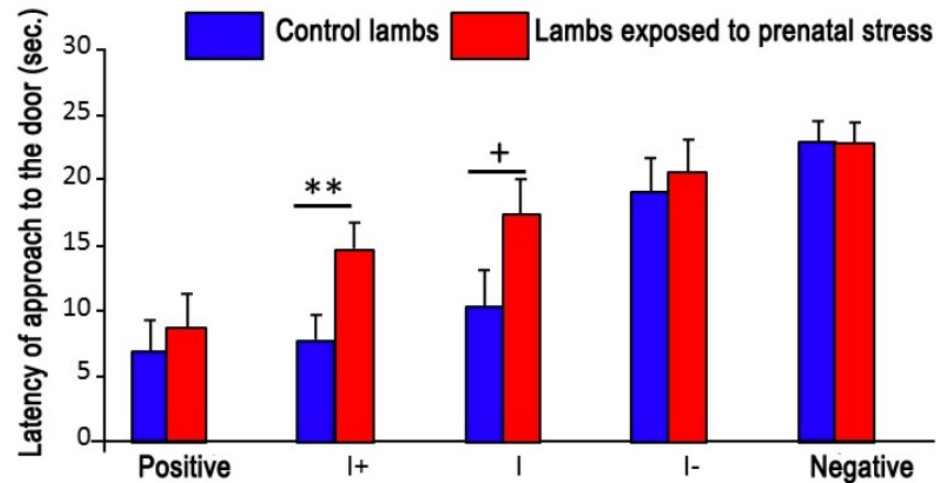
In utero : impact of prenatal stress

At birth



Spine density in terminal apical branches of pyramidal neurons located in CA1 hippocampus (* $p < 0.05$). Adapted from Petit et al 2015, Behavioural Brain Research 291:155-163

At 2.5 months of age



Latency of approach to the door depending on the location of the bucket. For training, the bucket was associated with a reward for the positive place and with a punishment for the negative place (go/no go paradigm). Coulon et al 2015 Developmental Psychobiology 57:626-636.





Postnatal



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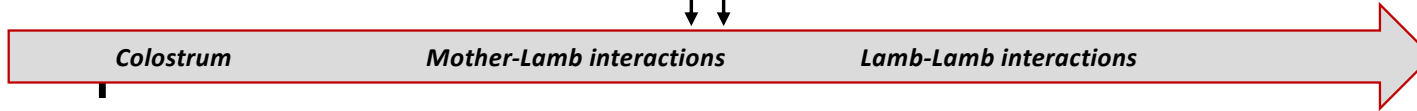


Postnatal

Lambs reared with their mother



Introduction of solid food for lamb
Weaning – Mother-Young separation



Birth



Mother withdrawal (24-48h) – formula-milk

Weaning – Milk withdrawal
Introduction of solid food



Lambs reared without mother with artificial milk

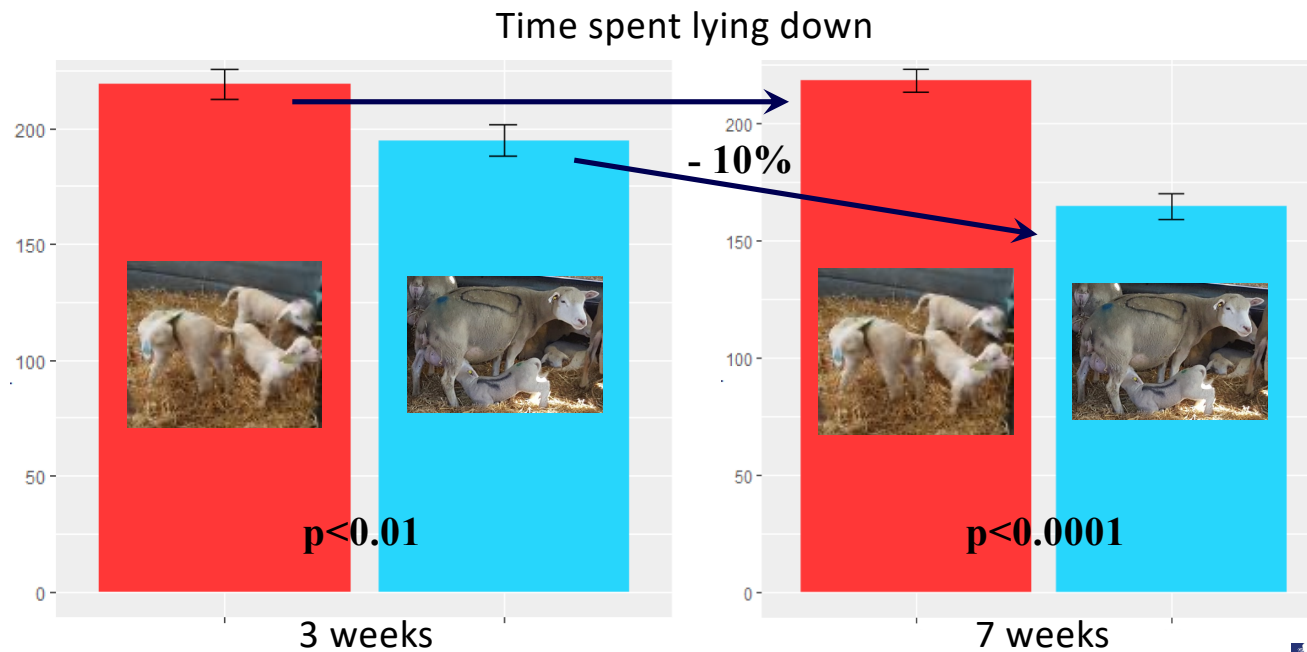




Postnatal

Behavioral development

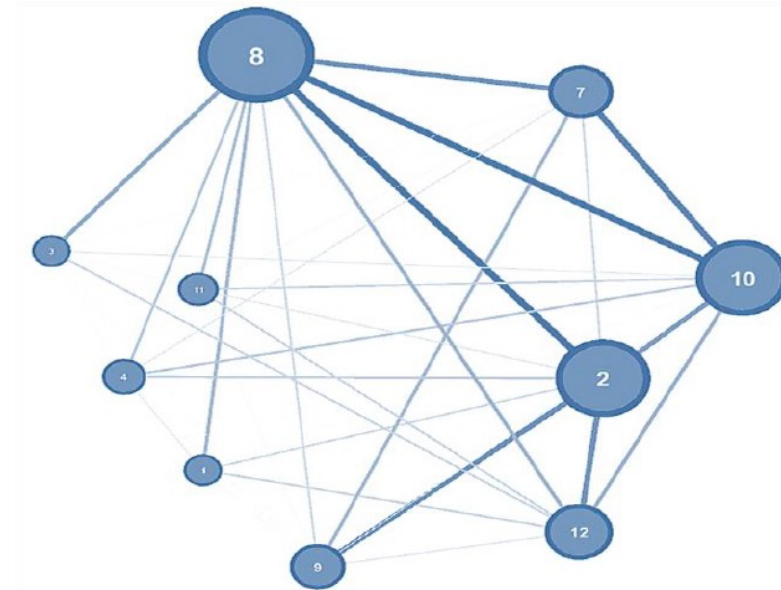
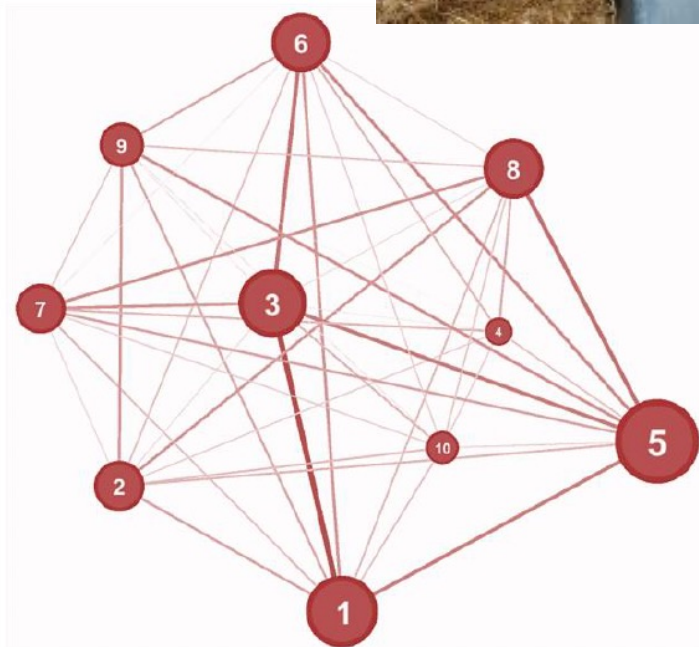
● mother-deprived lambs ◻ mother-reared lambs





Postnatal

● mother-deprived lambs □ mother-reared lambs



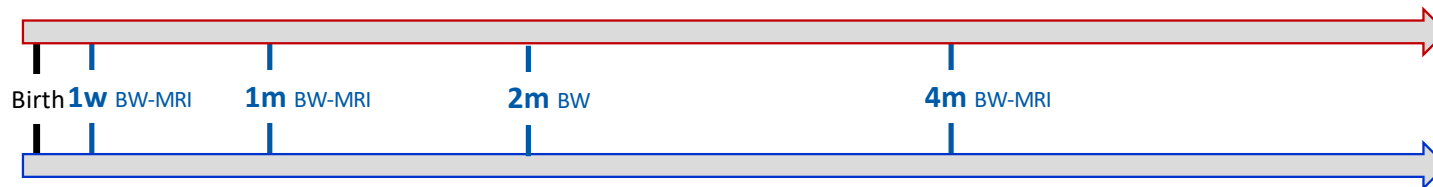
Behavioral development





Postnatal

Lambs reared with their mother



Lambs reared without mother with artificial milk

Brain development

*MRI (Siemens Magnetom Verio 3Te)
acquisitions*



Adapted from Love et al 2022 Developmental Neurobiology 82:214-232.



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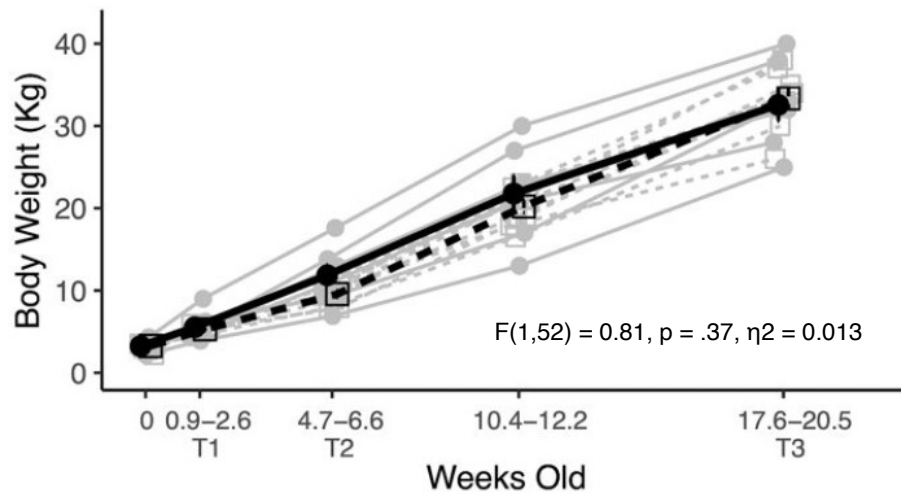
Postnatal

Brain development

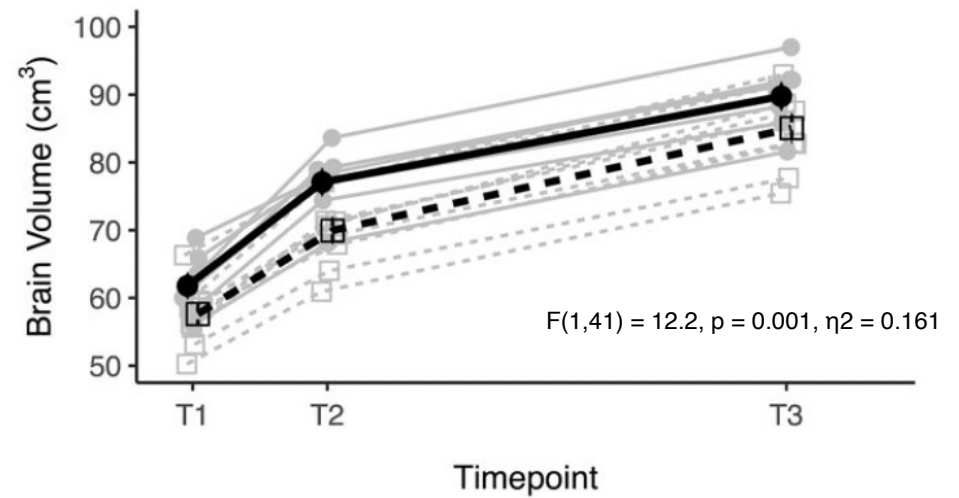
● mother-deprived lambs □ mother-reared lambs



Body weights



total brain volumes

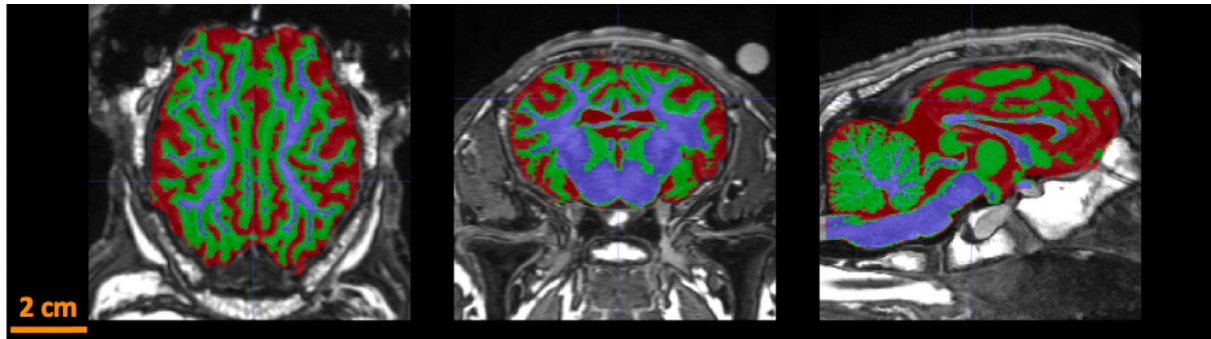


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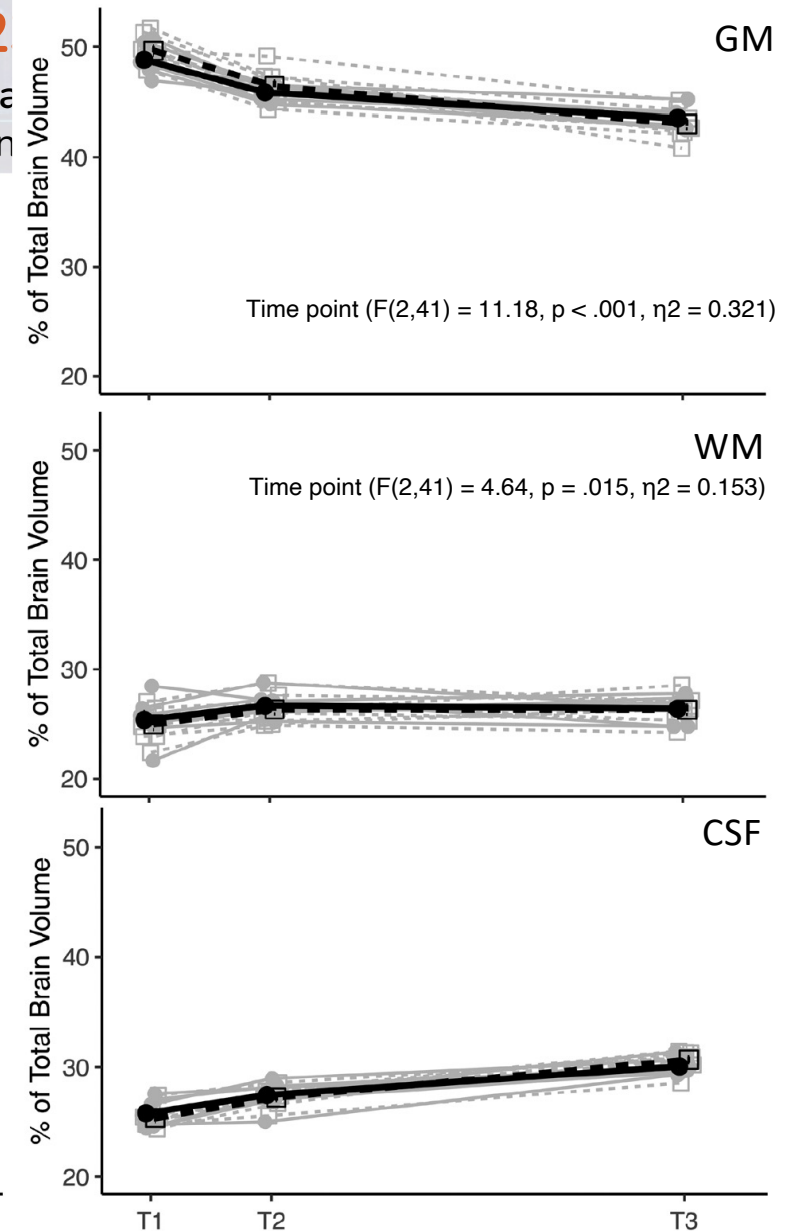
Postnatal

—●— mother-deprived lambs —□— mother-reared lambs



GM, WM and CSF % of total brain volume : No Effect of early experience

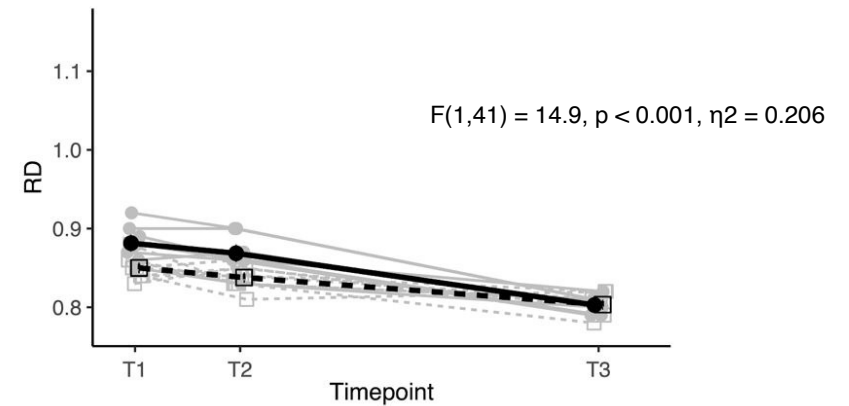
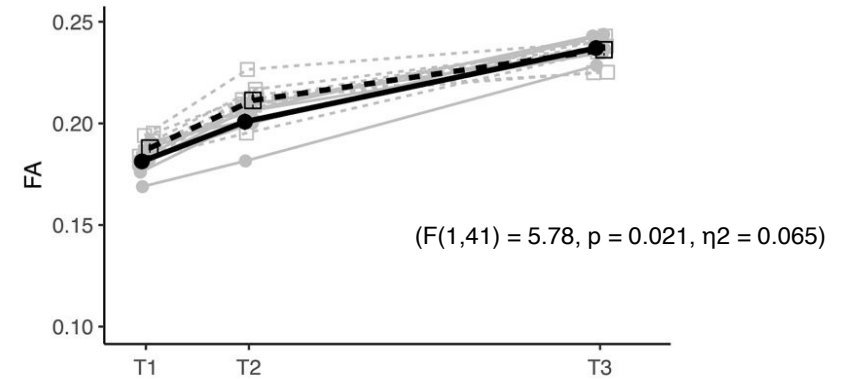
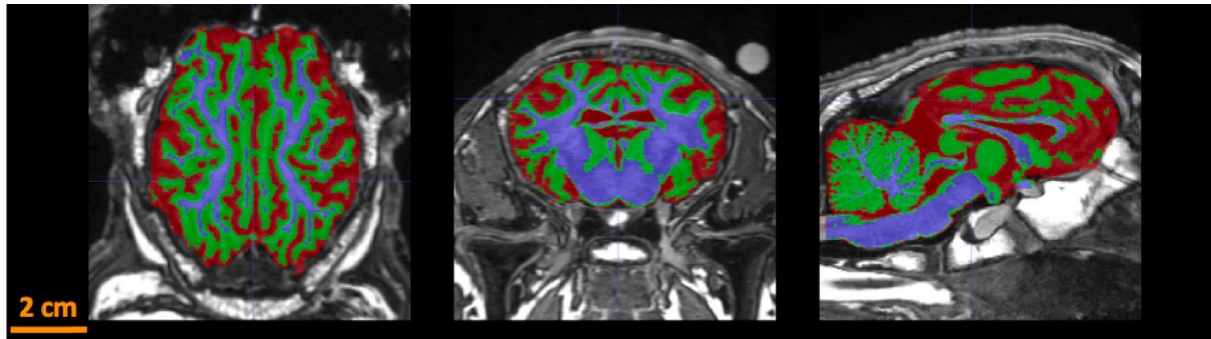
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Postnatal

● mother-deprived lambs □ mother-reared lambs



Adapted from Love et al 2022 Developmental Neurobiology 82:214-232.





Why investigate cognition in lambs according to early experience?

Because lambs and sheep could be relevant preclinical models for investigating brain and social behavioural human disorders



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Why investigate cognition in lambs according to early experience?

Because lambs and sheep could be relevant preclinical models for investigating brain and social behavioural human disorders

To better understand how lambs perceive and react to their environment, and thus participate in improving their well-being.





INRAE

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Experimental units



APR Ovin2A, APR Neuro2Co

INRAE
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et Systèmes d'Élevage

Prebiostress, PhenoMatHyp



Expérience précoce et développement neuroendocrinien



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Thank you for your attention



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