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# Impact of early experience on brain development and cognition in lambs

Elodie Chaillou

► **To cite this version:**

Elodie Chaillou. Impact of early experience on brain development and cognition in lambs. NeuroFrance 2023, Société des Neurosciences, May 2023, Lyon, France. hal-04219797

**HAL Id: hal-04219797**

**<https://hal.inrae.fr/hal-04219797v1>**

Submitted on 27 Sep 2023

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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

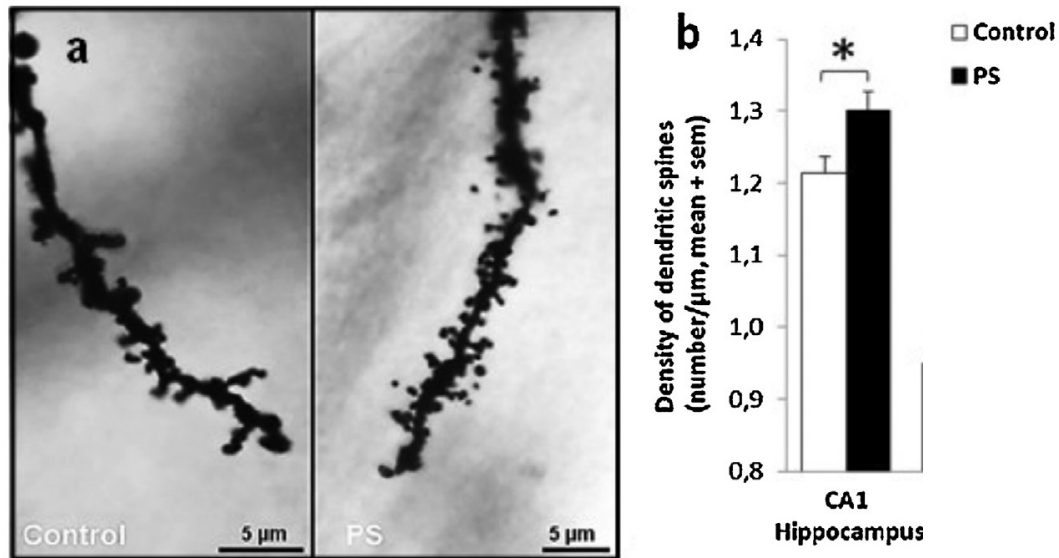
*In utero*  
*Postnatal*





## In utero : impact of prenatal stress

### At birth



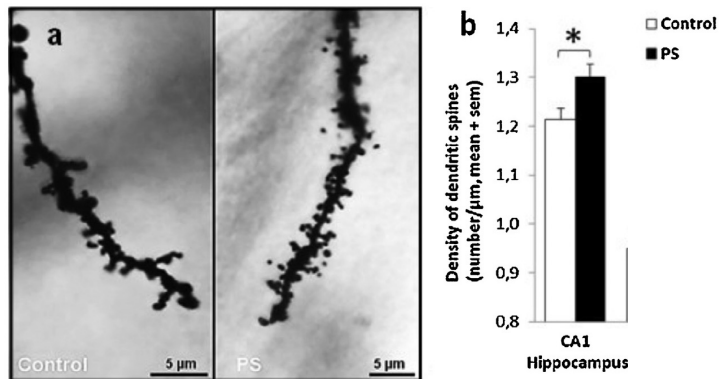
Spine density in terminal apical branches of pyramidal neurons located in CA1 hippocampus (\*  $p < 0.05$ ). Adapted from Petit et al 2015, Behavioural Brain Research 291:155-163





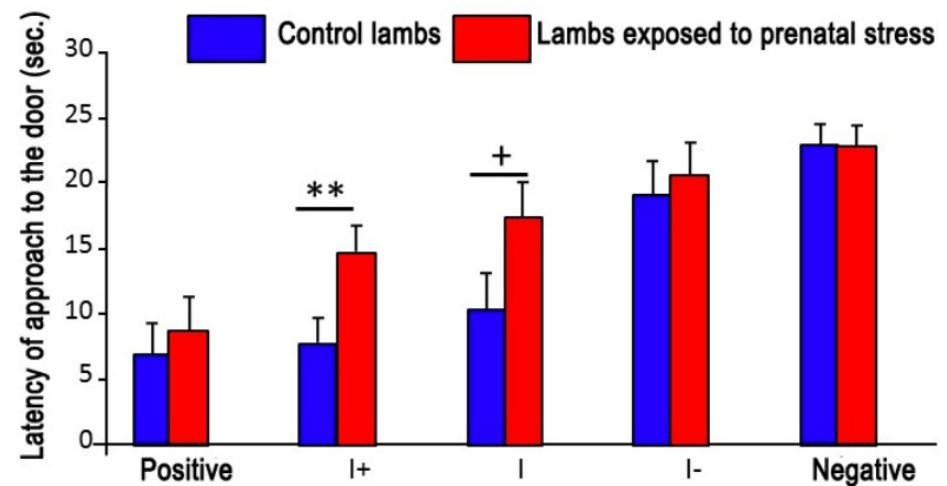
## In utero : impact of prenatal stress

### 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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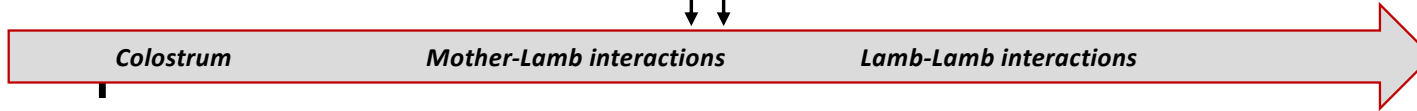


**Postnatal**

**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**

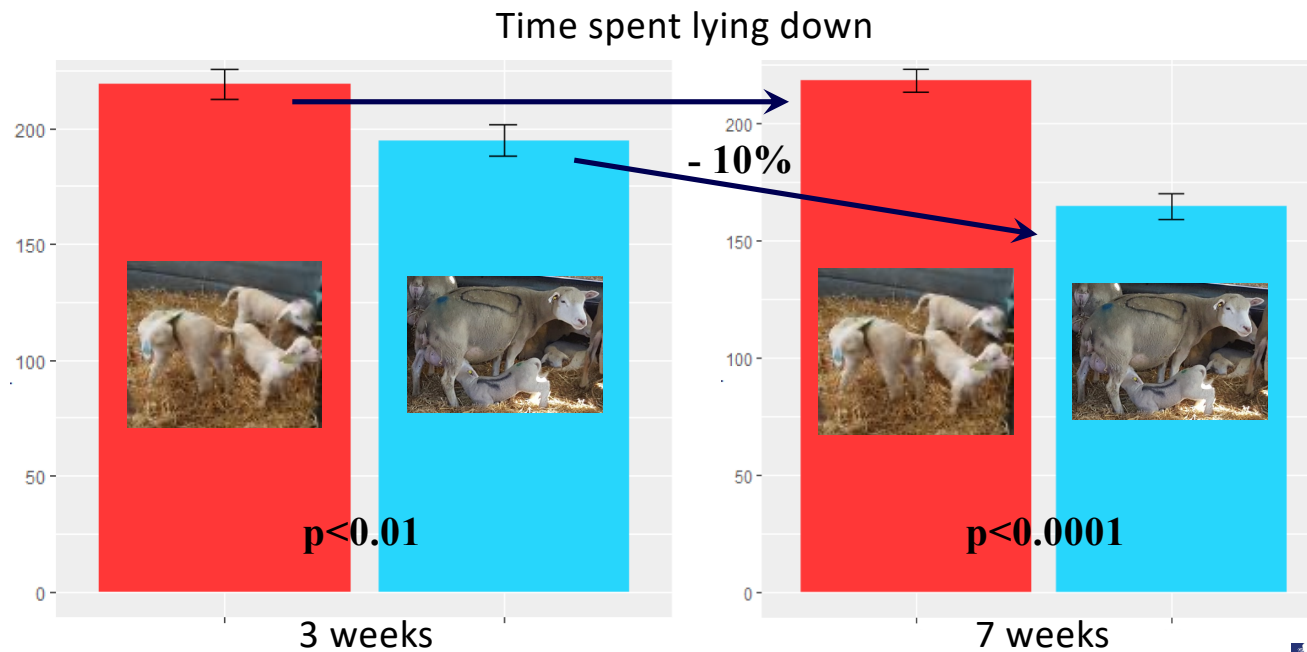




## Postnatal

## Behavioral development

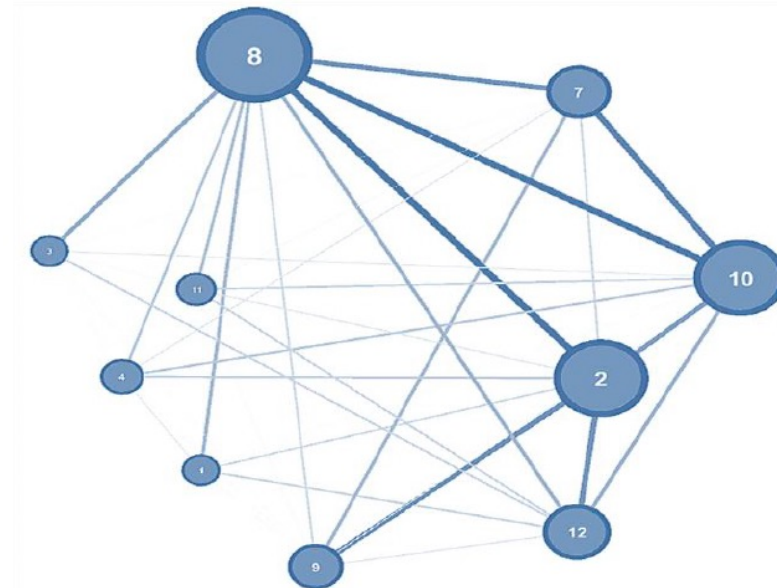
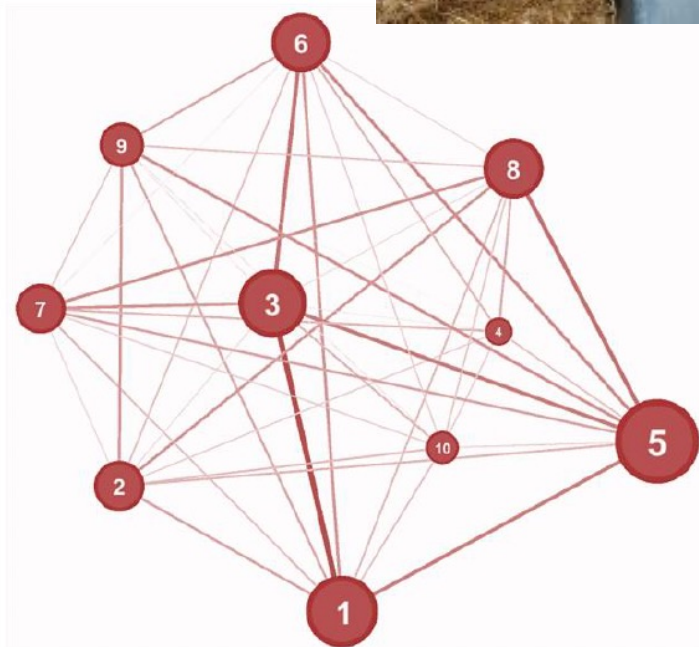
● mother-deprived lambs    ◻ mother-reared lambs





## Postnatal

● mother-deprived lambs    □ mother-reared lambs



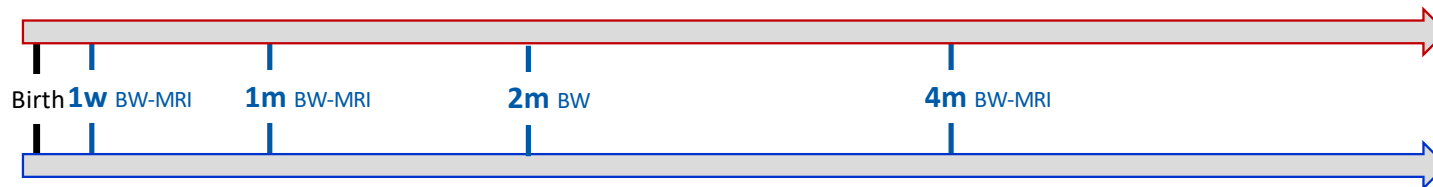
## Behavioral development





## 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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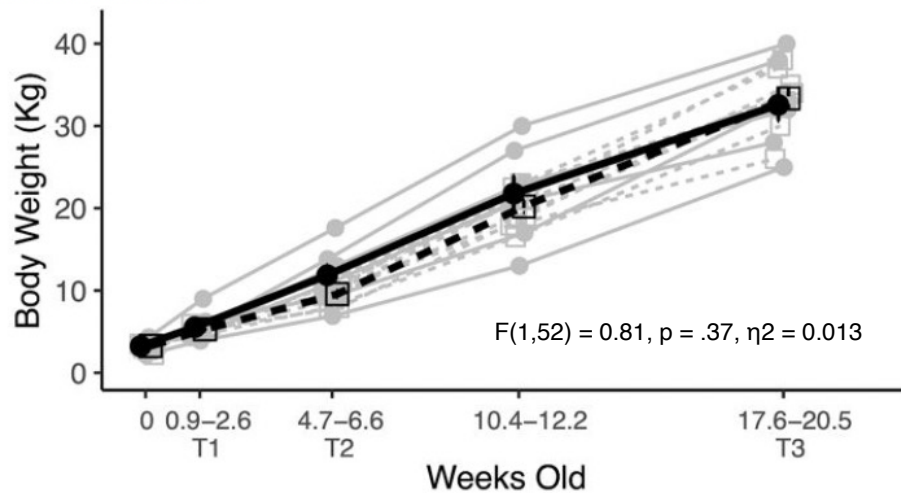
## Postnatal

## Brain development

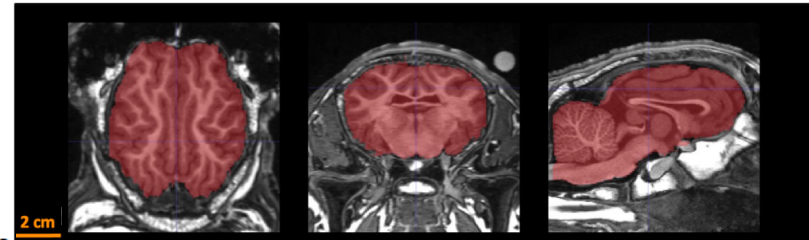
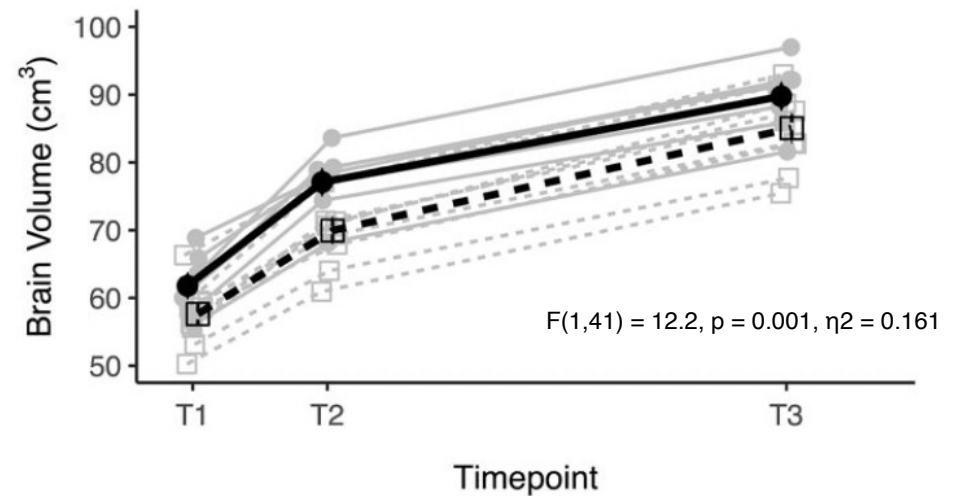
● mother-deprived lambs    □ mother-reared lambs



Body weights



total brain volumes

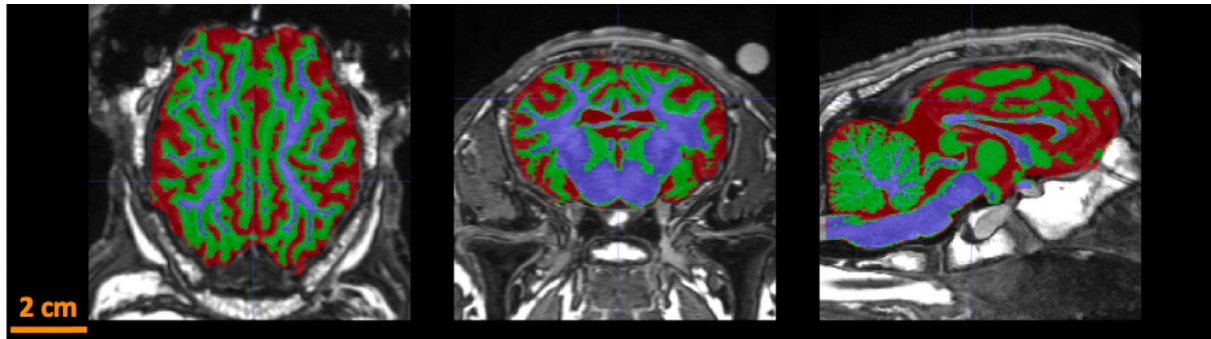


Adapted from Love et al 2022 Developmental Neurobiology 82:214-232.



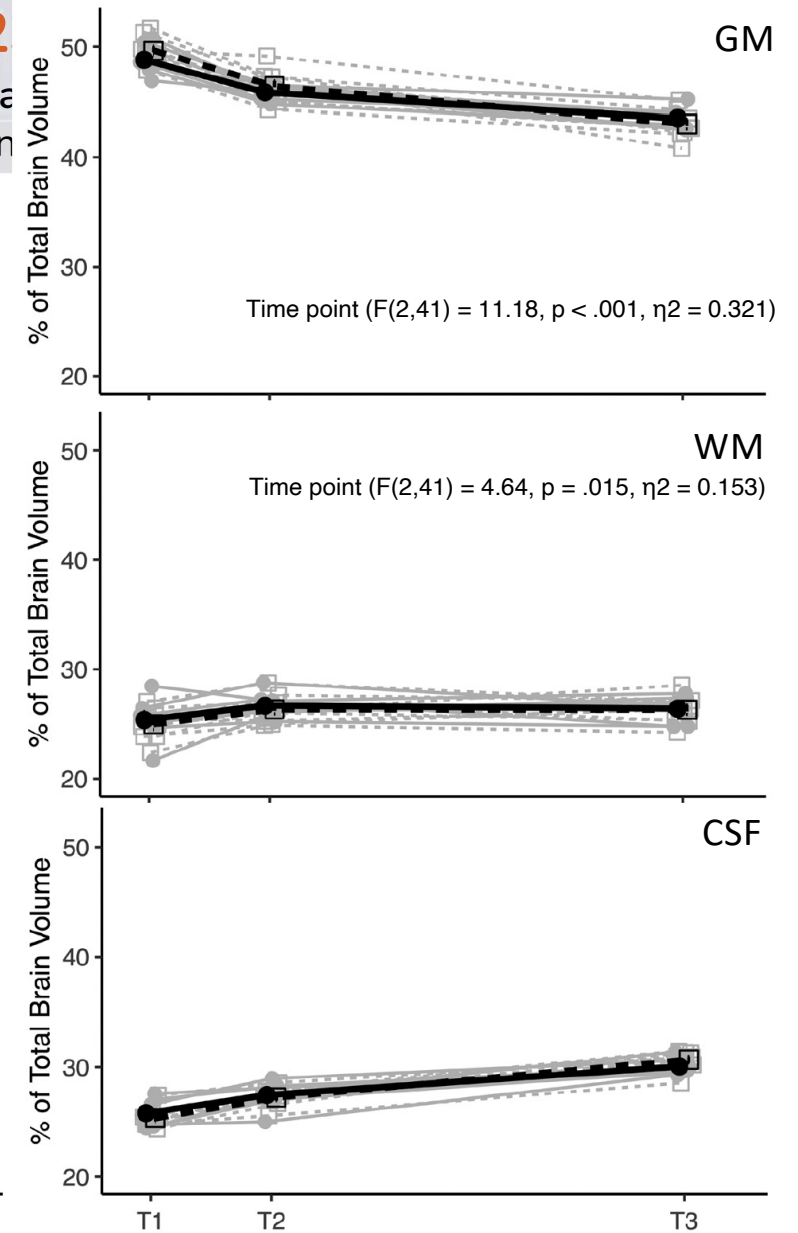
Postnatal

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



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

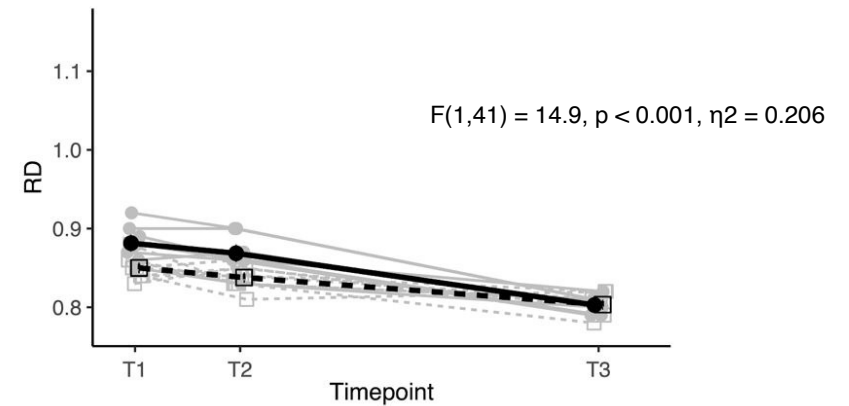
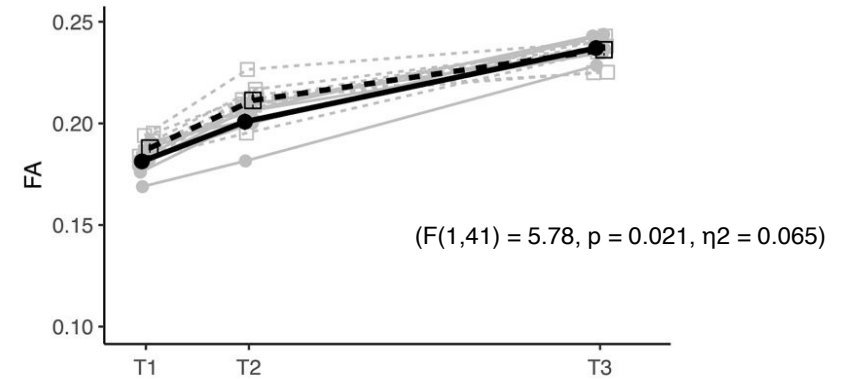
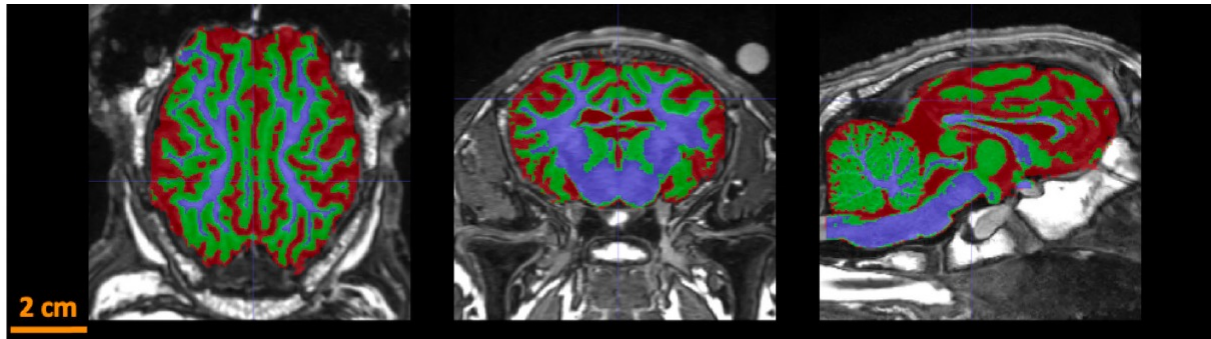
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## Postnatal

● 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

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Physiologie Animale  
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Prebiostress, PhenoMatHyp



Expérience précoce et développement neuroendocrinien

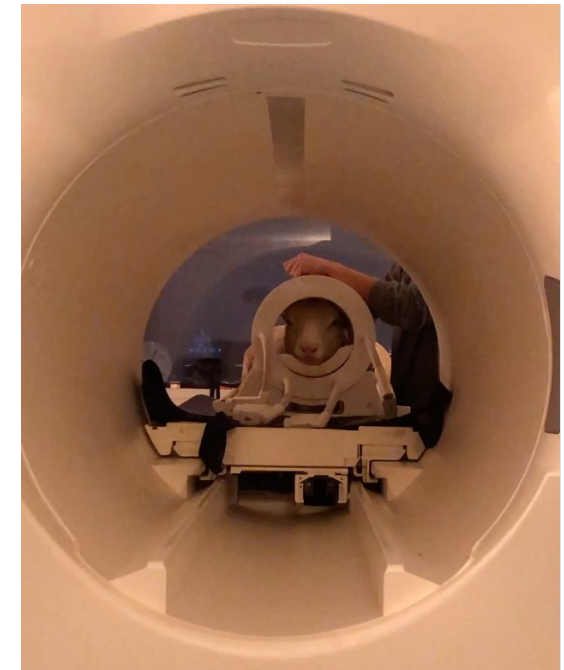


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*Thank you for your attention*



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