UMR1213 Herbivores

Adaptation and Social Behaviors Team (ACS)

Behavioural and neurobiological development of lambs are influenced by prenatal stress and post-weaning enrichment

The ANR project PsySheep showed that a stressful experience during gestation alters the maternal behaviour of ewes and makes their lambs more fearful and pessimistic. Environmental enrichment after weaning can correct these effects. These changes in emotional reactivity and cognitive processes of lambs are associated with changes in their brain development.

Stress experienced by the mother during pregnancy can affect the emotional behaviour and cognitive performances of children (hyperactivity, attention deficit...) and predispose them to psychiatric disorders. Behavioural therapies in children can reduce these mental disorders (Weinstock, 2001). In farm animals, females can be exposed to stressful conditions during gestation, which can have deleterious effects on their offspring. The consequences of 'prenatal stress' have been studied mainly in rodents (Braastad, 1998). However, most livestock are precocial species in which new-borns have already gained maturity at birth and receive maternal care, in contrast to rodents where most of the nervous maturation occurs after birth. These differences in neurobiological development and maternal care prevent any generalization from rodents to livestock. The ANR PsySheep project (2012-2014) aimed at characterizing the psychobiological effects of prenatal stress and post-weaning enrichment in sheep, these animals being both a target and model species for other livestock.

During the last two months of gestation, ewes were subjected to a stressful treatment (social separation, changes in pen, noise, handling...), previously validated (Destrez et al., 2012). After weaning, lambs were raised in an environment either standard or enriched (brush offered, early distribution of food...)

- The ewes stressed during gestation express less maternal motivation at lambing.
- The lambs born from stressed ewes are more fearful, perceive more negatively their environment, and exhibit learning deficits. The lambs that received the post-weaning enrichment treatment are less reactive towards a man or a new object.
- The analysis of brain morphology shows that lambs born from stressed ewes developed more dendritic spines of pyramidal neurons in the hippocampus and prefrontal cortex. After the post-weaning enrichment treatment, the density of dendritic spines was similar between lambs from stressed ewes and those from control ewes.

A stressful experience during gestation alters maternal behaviour of ewes at lambing and makes their lambs more fearful and pessimistic, which could be related to changes in brain development. The enrichment of housing conditions after weaning minimizes these effects in lambs. Strategies limiting stress in pregnant farm animals and enriching the rearing environment should be promoted to improve animal welfare.

Publication/patent

Coulon M, Lévy F, Ravel C, Nowak R, Boissy A., 2014. Mild effects of gestational stress and social reactivity on the onset of mother-young interactions and bonding in sheep. Stress. 17(6): 460-70.

Depiets B, Coulon M, Andanson S, Bes S, Chaillou E, Lévy F, Nowak R, Boissy A., 2014. Prenatal stress modifies the dendritic spine density in hippocampus and prefrontal cortex of lambs at birth whereas the genes expression in dendritic morphology and synaptic transmission is not altered. Proceedings of FENS 2014, 1366.

Contact : Boissy Alain, alain.boissy@clermont.inra.fr, UMR1213 Herbivores, F-63122 Saint-Genès-Champanelle, France.