Underfeeding affects IGF-1 and gene expression in genital tract tissues in high producing dairy cows

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Session 22. Promising applications of Nutrigenomics in animal science

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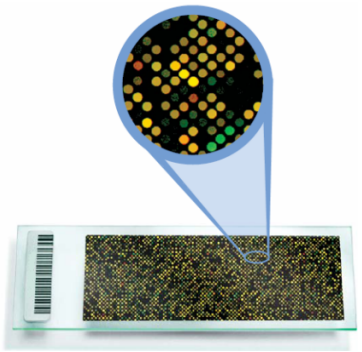
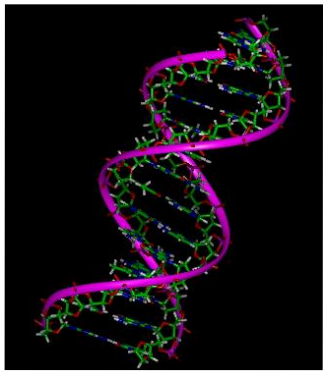
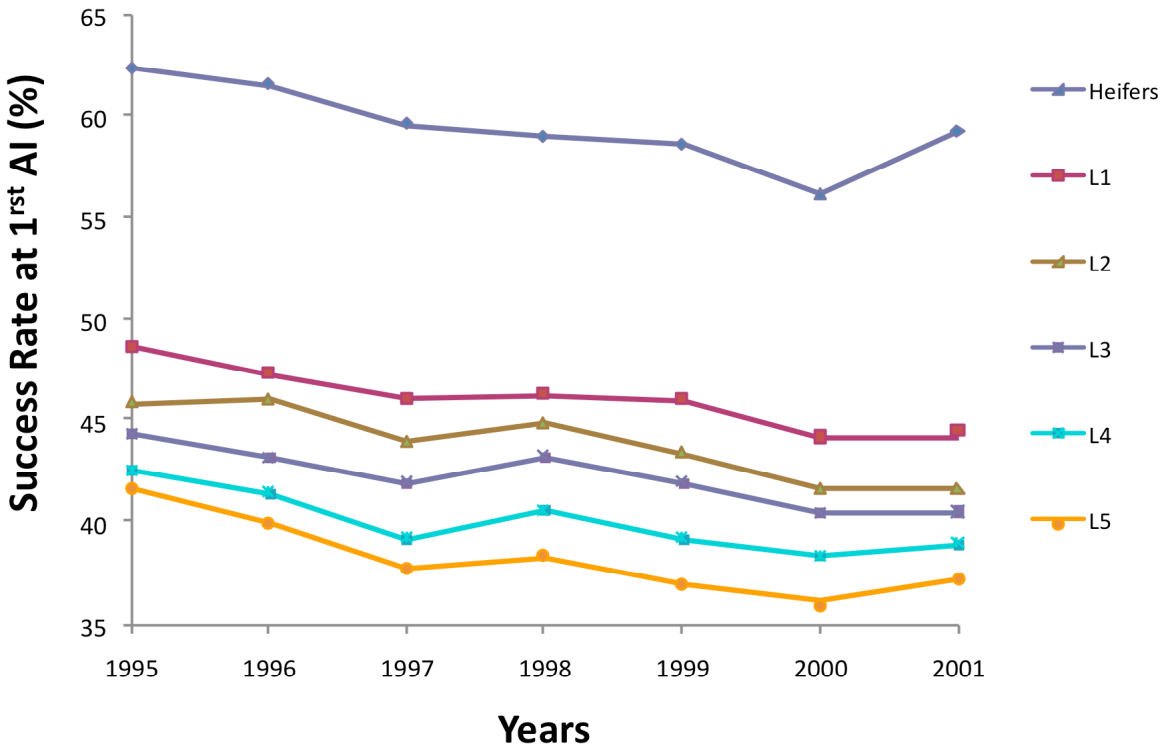




ALIMENTATION
AGRICULTURE
ENVIRONNEMENT

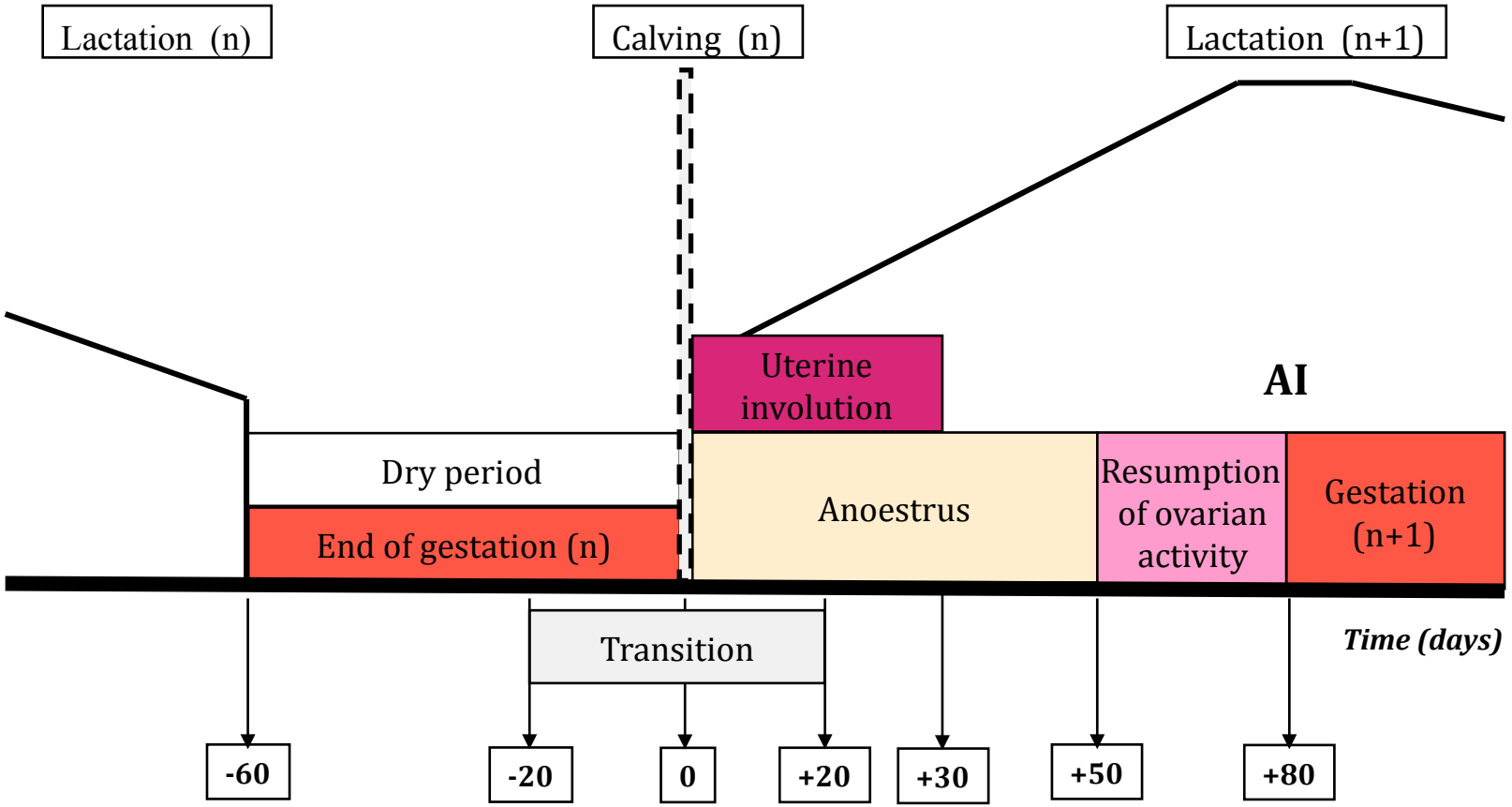
Decline in fertility in dairy cows

Evolution in the fertility rate at first AI between 1995 and 2001 (Boichard *et al.*, 2002a)



✓ Decrease of success rate (1rst AI) at 90 days postpartum
✓ Phenomenon increasing with the number of lactation

Particular physiology of the HPDC during the peripartum period



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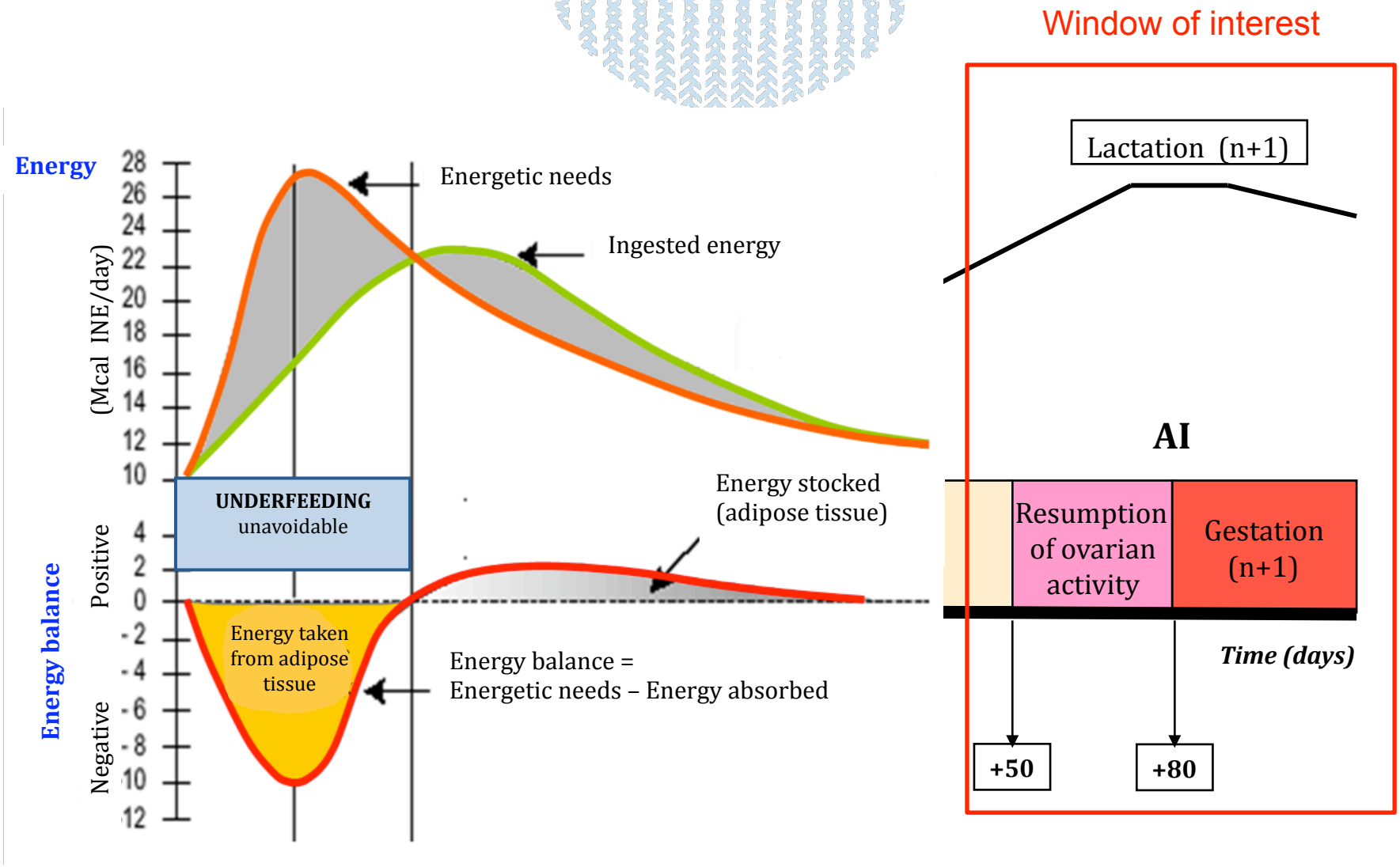
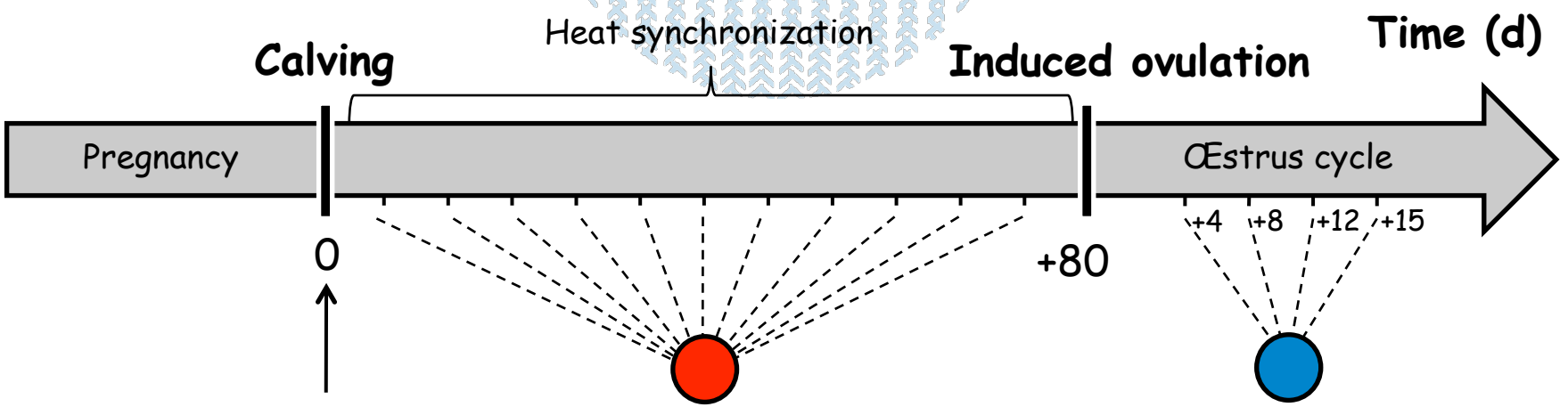
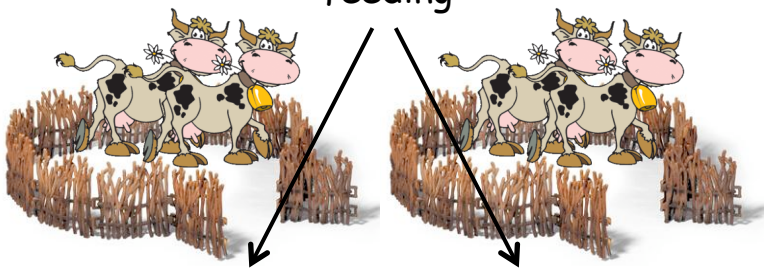


Experimental design





100% INRA requirements (n=4 females) →MNEB

40% INRA requirements (n=4 females) →SNEB

Glucose metabolism :
- Glucose
- Insulin

Lipid metabolism :
- NEFA
- BOH

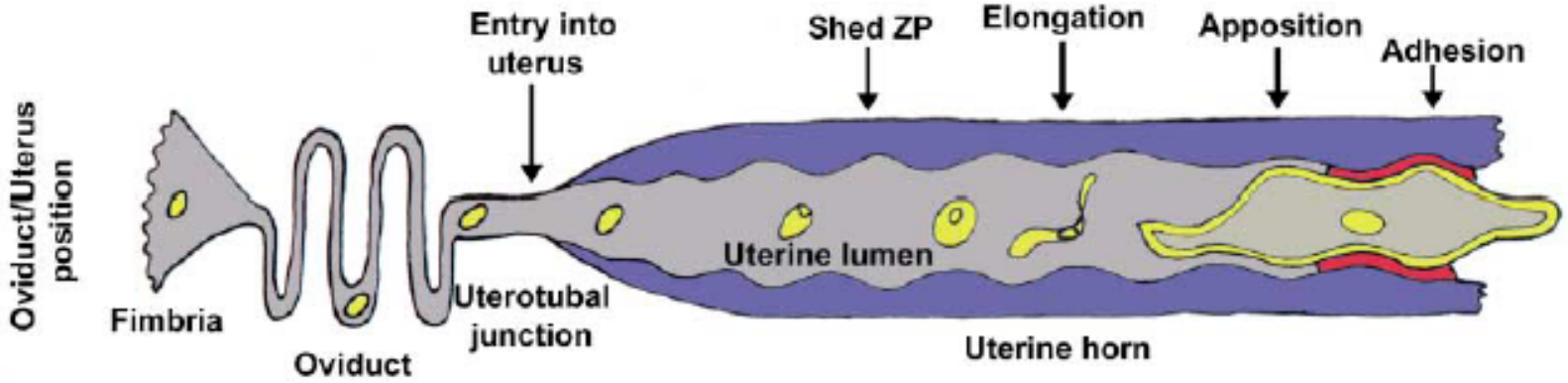
Protein metabolism :
- Urea

Growth factor :
- IGF-1

- Oviduct
- Endometrium
- Corpus luteum

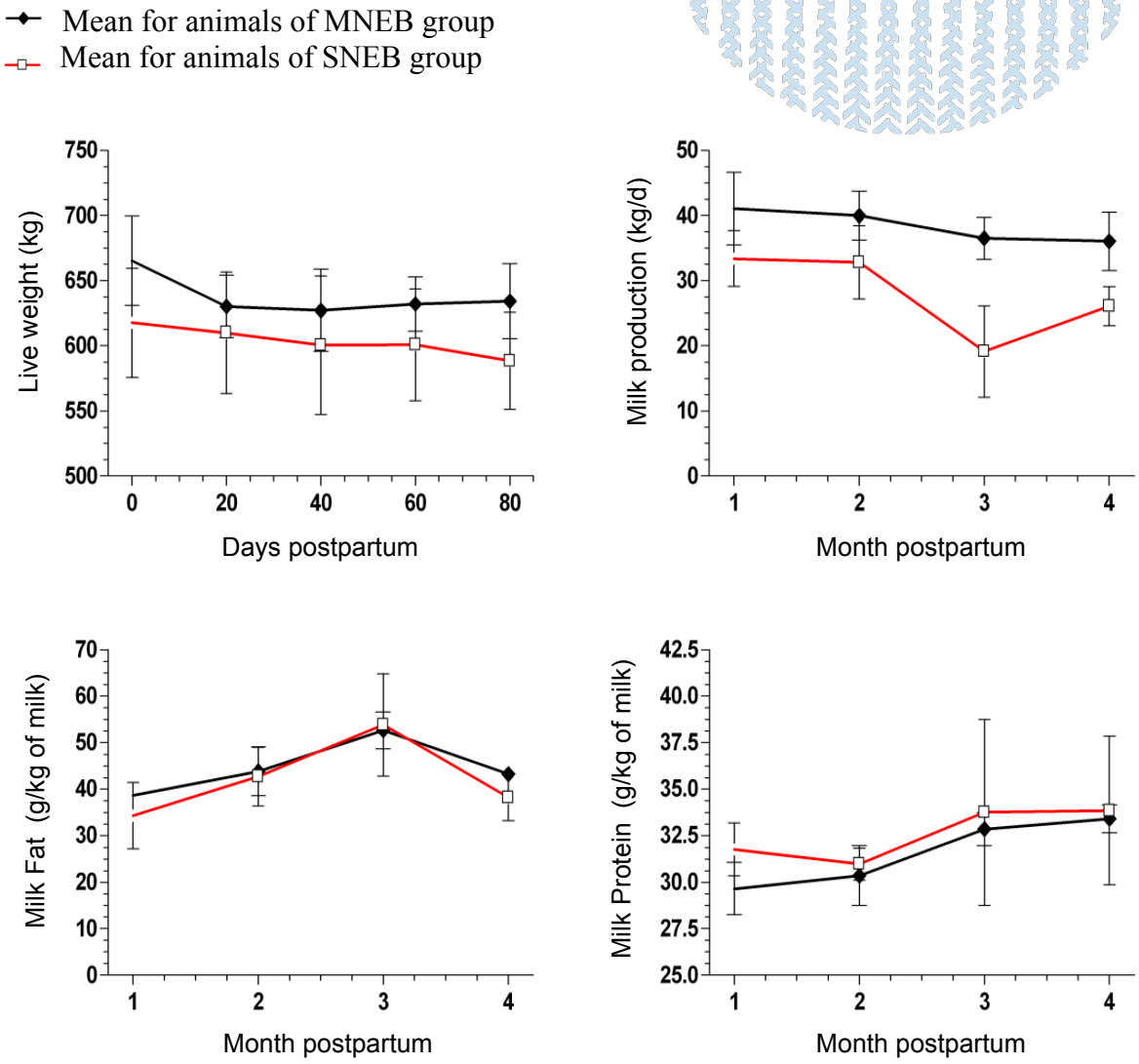
How can we define unfertility?

Bad quality oocytes (no fertilization)
Early embryonic loss (+30% of total loss)



Spencer, 2004

Results about animal performance (1) and metabolism (2)

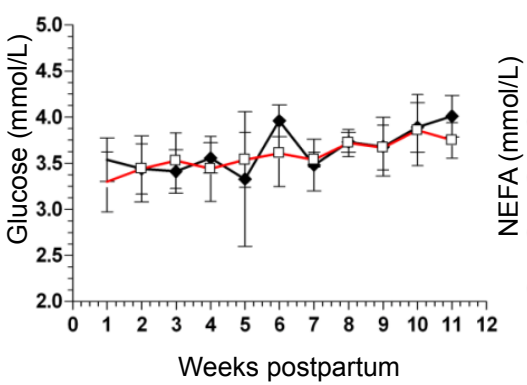


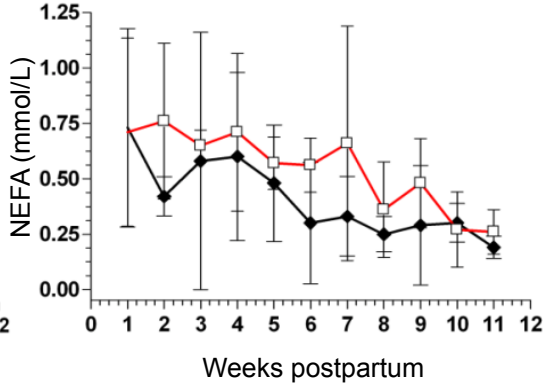
✓ Live weight and milk production affected by dietary treatment

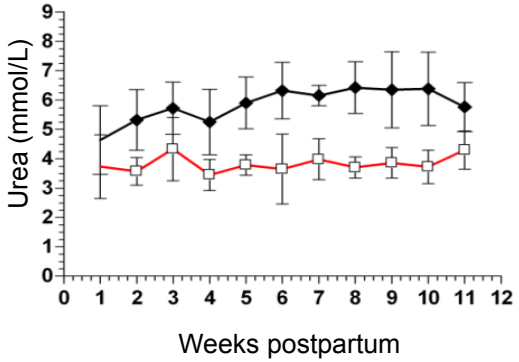
✓ No modifications of milk quality

Results about zootechny (1) and metabolism (2)

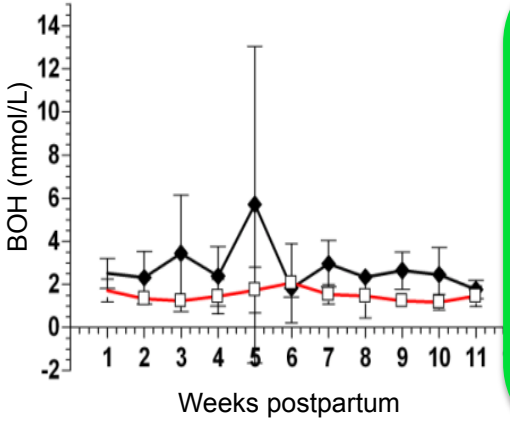
Mean for animals of MNEB group
Mean for animals of SNEB group

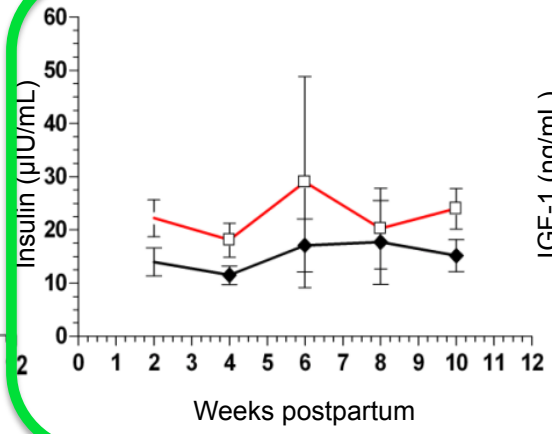


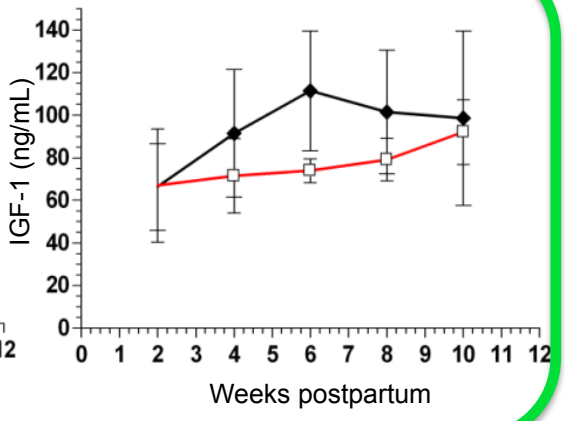




✓ Metabolites evolutions confirm the protocol







✓Insulin and IGF-1 are significantly ($P<0.05$) different between SNEB & MNEB groups

Results of transcriptomic approach (3) : genes differentially expressed

✓Data were established hybridazing (cDNA) macroarray 10K
✓Differential (SNEB vs MNEB) statistical approach using « R » (VarMixt/Limma/SMVar)

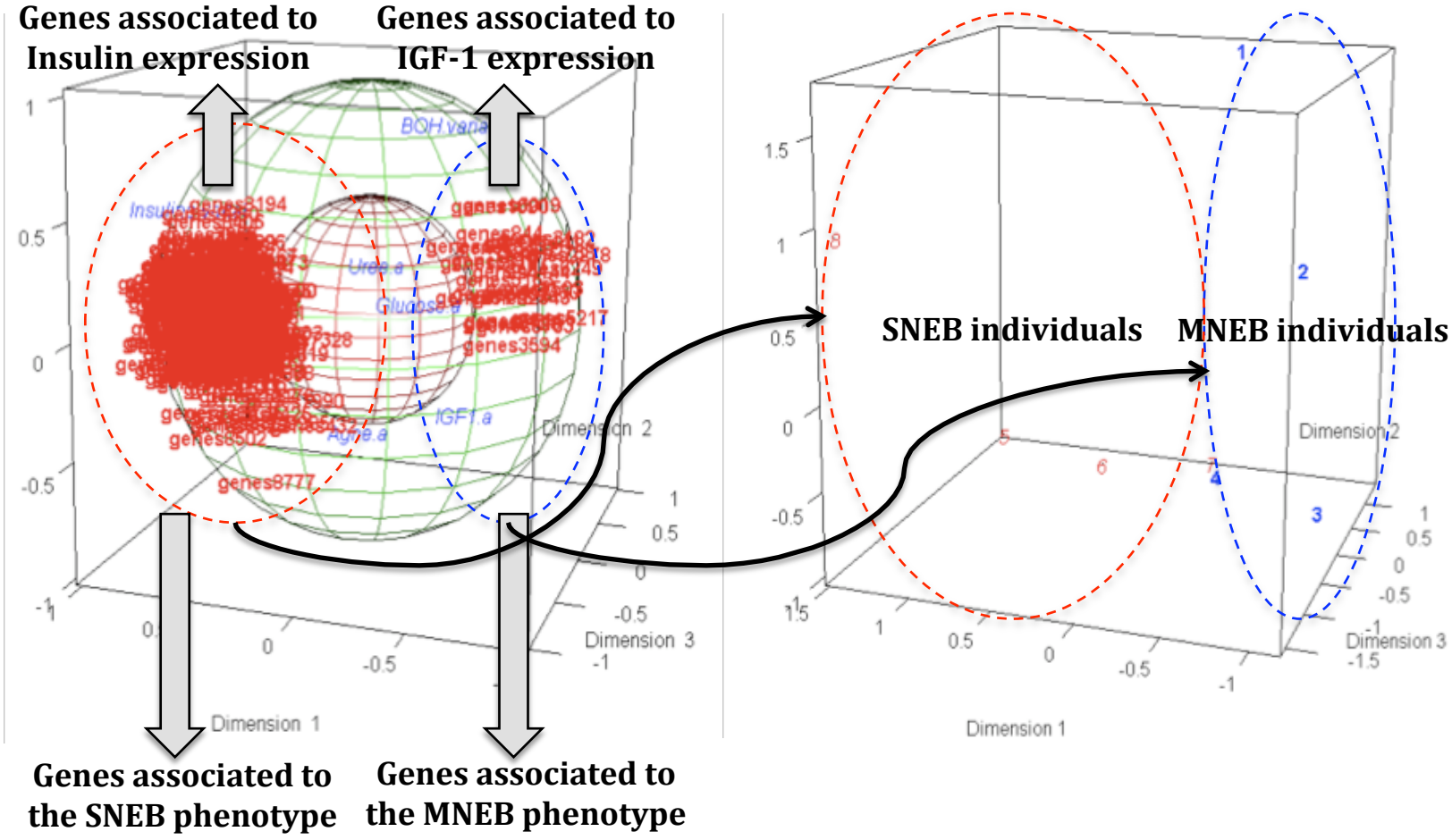
Tissue	Number of differentially expressed genes between SNEB *vs* MNEB group using *adjusted p-value* (FDR = BH) P≤α			
	α=0,05	α=0,11	α=0,15	α=0,30
Oviduct	0	293	1370	3830
Endometrium	0	1	3	28
Corpus luteum	0	0	0	0

✓ **High sensitivity of the oviduct** to the NEB
✓ The Endometrium is less sensitive
✓No sensitivity of the corpus luteum to the NEB : induced by synchronization protocol?

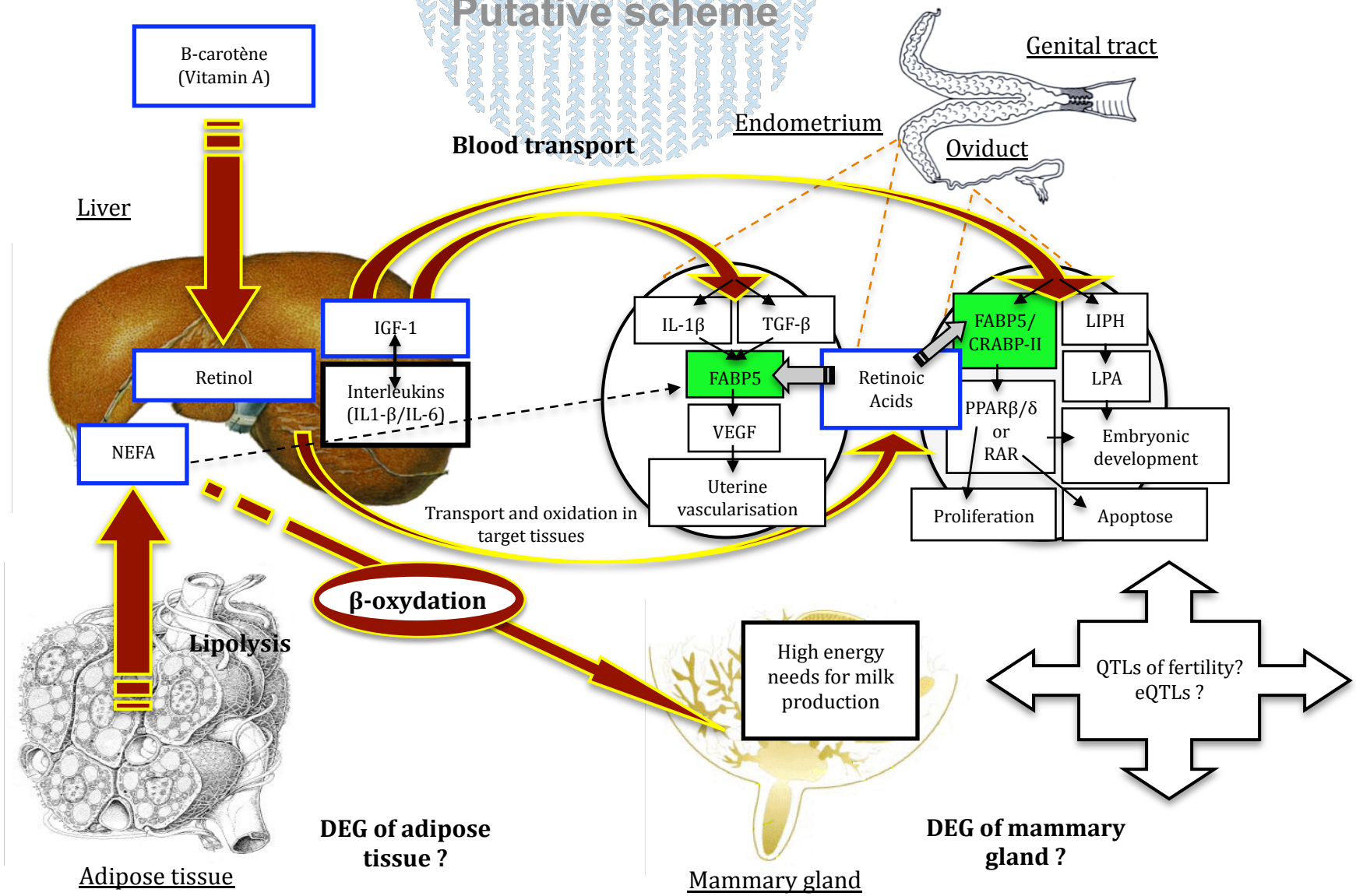
✓IPA network were generated
✓Canonical pathways were highlighted

Powerfull statistical analysis

- ✓ Can we established a link between metabolic and genomic data?
- ✓ Using gene expression data & metabolites evolution parameters : Canonical analysis



Putative scheme



Conclusions and Perspectives

Conclusions:

- ✓ IGF-1 and Insulin seem to be good predictors of NEB status
- ✓ Oviduct is affected more than other tissues by NEB 15 days after ovulation
- ✓ Canonical pathways (Lipid transport, immune response, & more) are affected by NEB
- ✓ We can correlate metabolism and gene expression to establish a putative scheme

Perspectives:

- ✓ Gene validations using specific technique (RT-qPCR)
- ✓ DEG mammary gland + adipose tissue, QTLs?
- ✓ Focus on the embryo-maternal dialogue (PhD)

Thank you for your attention!