Muscle-to-Brain communication in the context of obesity: impact of physical exercise?

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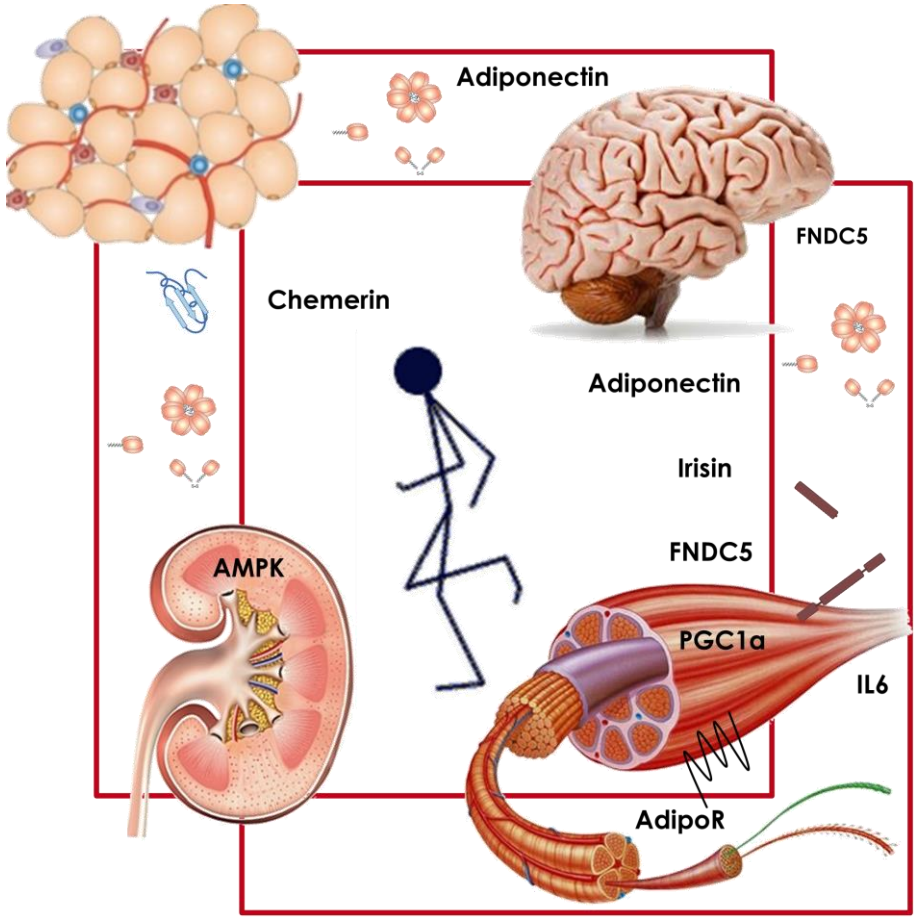
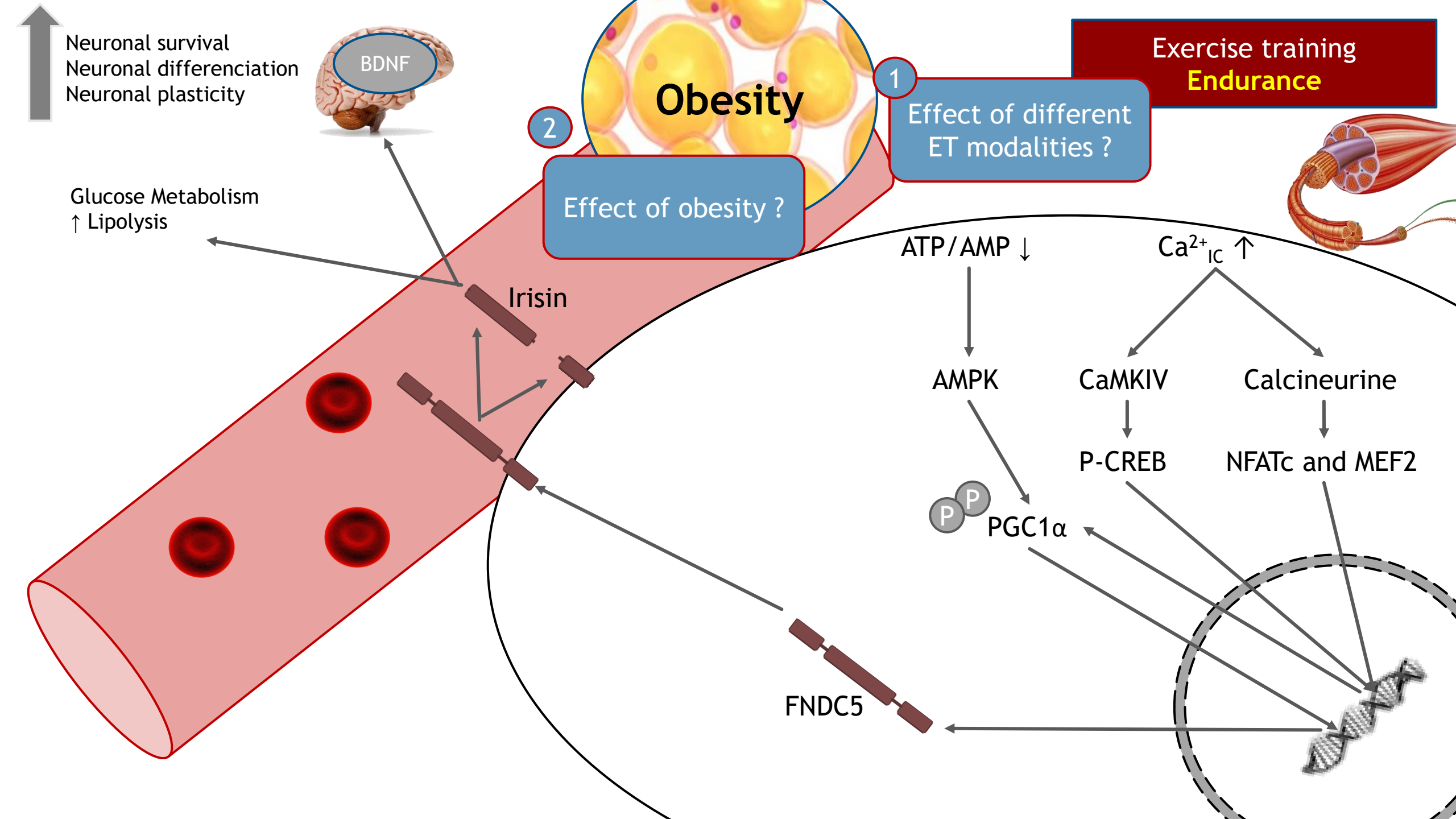
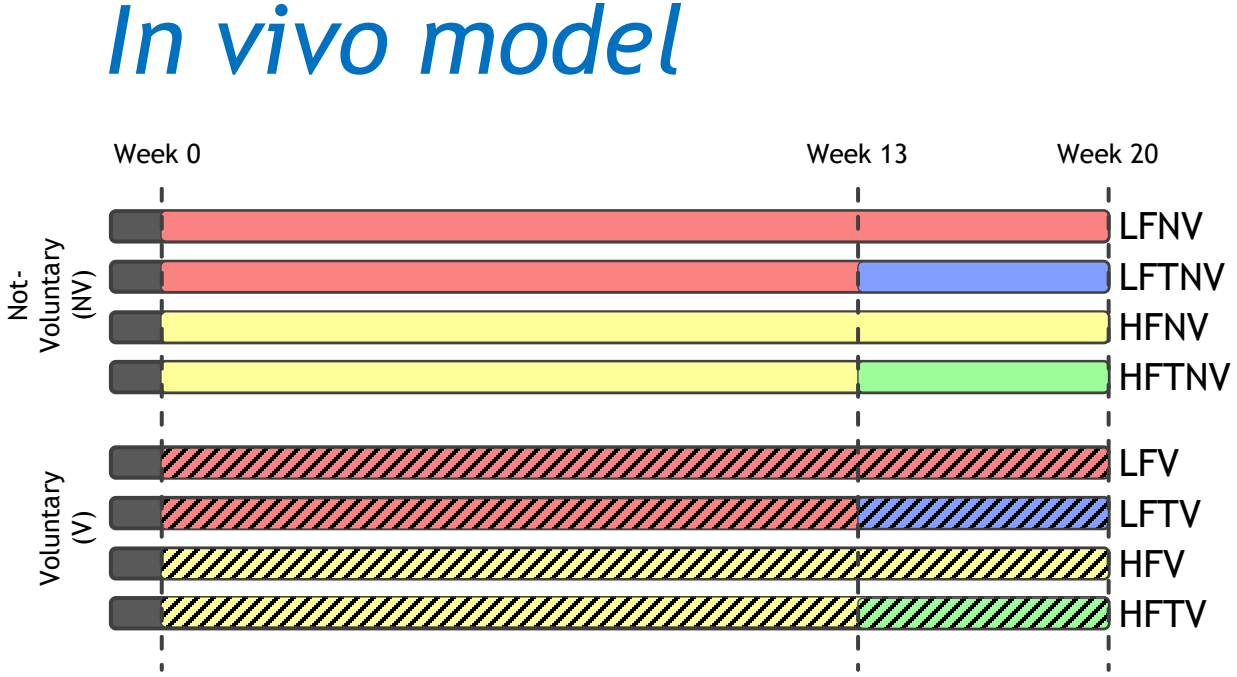
« *Mens sana in corpore sano* »

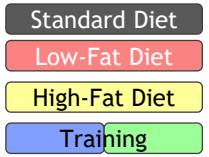


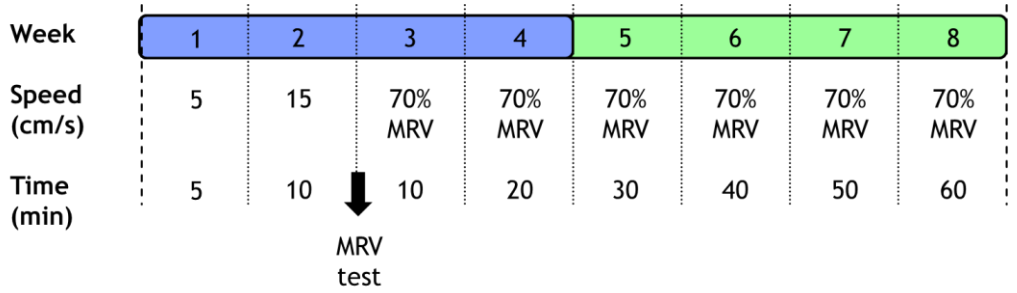
Iris, Messenger of Gods


Neuronal survival
Neuronal differenciation
Neuronal plasticity
BDNF
Obesity
2
Effect of obesity ?
1
Effect of different ET modalities ?
Exercise training
Endurance
Glucose Metabolism
↑ Lipolysis
Irisin
ATP/AMP ↓
Ca2+IC ↑
AMPK
CaMKIV
Calcineurine
P-CREB
NFATc and MEF2
P
P
PGC1α
FNDC5

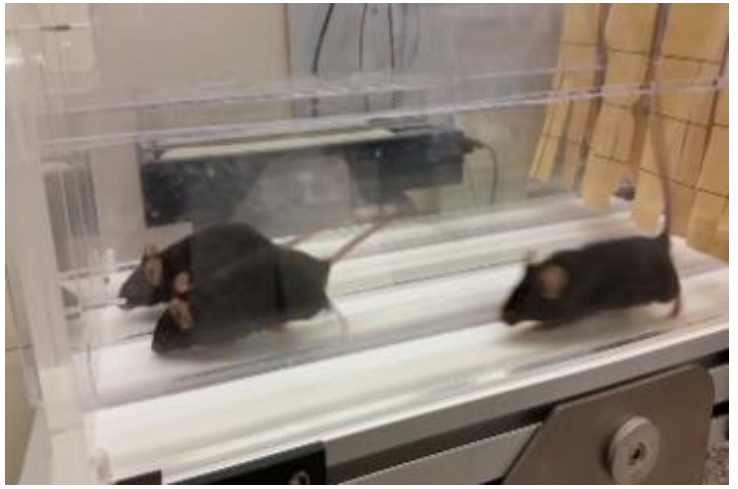
In vivo model





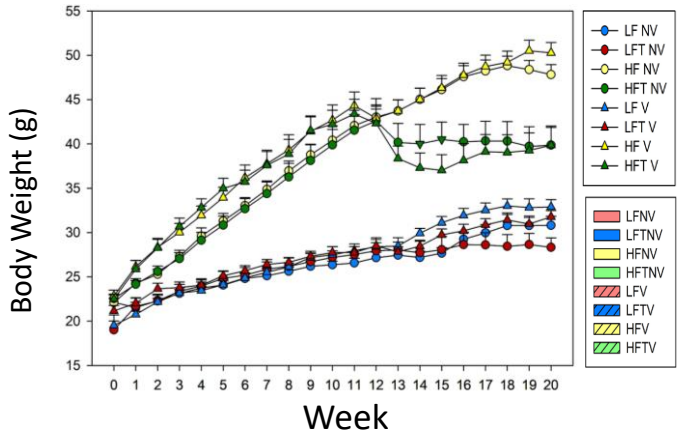


Voluntary (V)

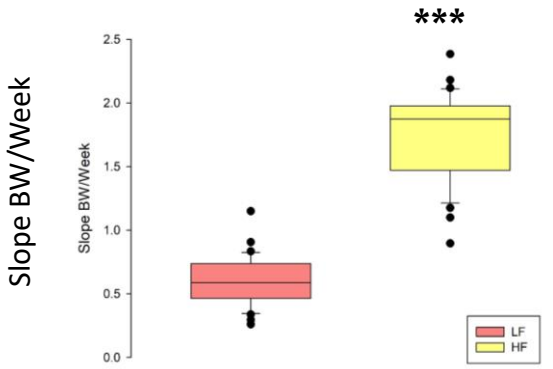


Not-Voluntary (NV)

Exercise training stabilizes body weight and restores fasting glycaemia in High-Fat diet mice

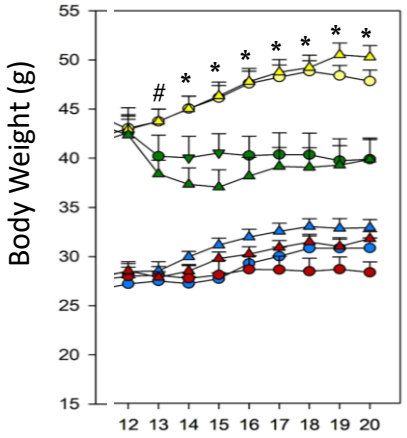


Before Training



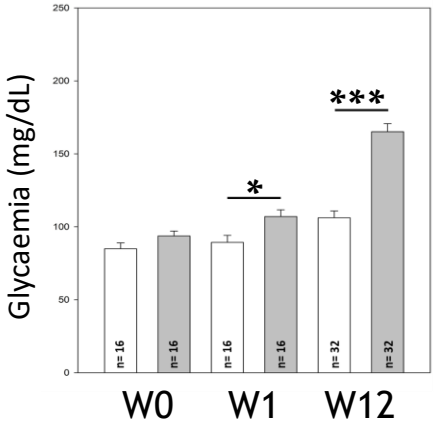
Mann-Whitney Rank Sum Test; ***: p< 0,001

After Training

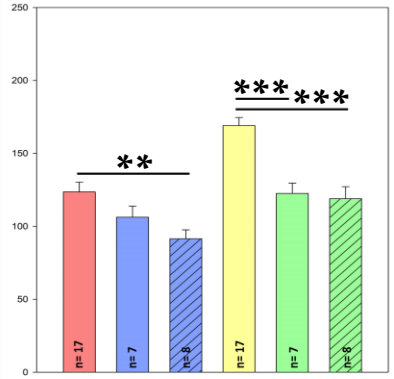


Two Way ANOVA on RM
# p<0,001 HFV Vs HFTV ;
* p<0,001 T vs UT in HF groups

Before Training

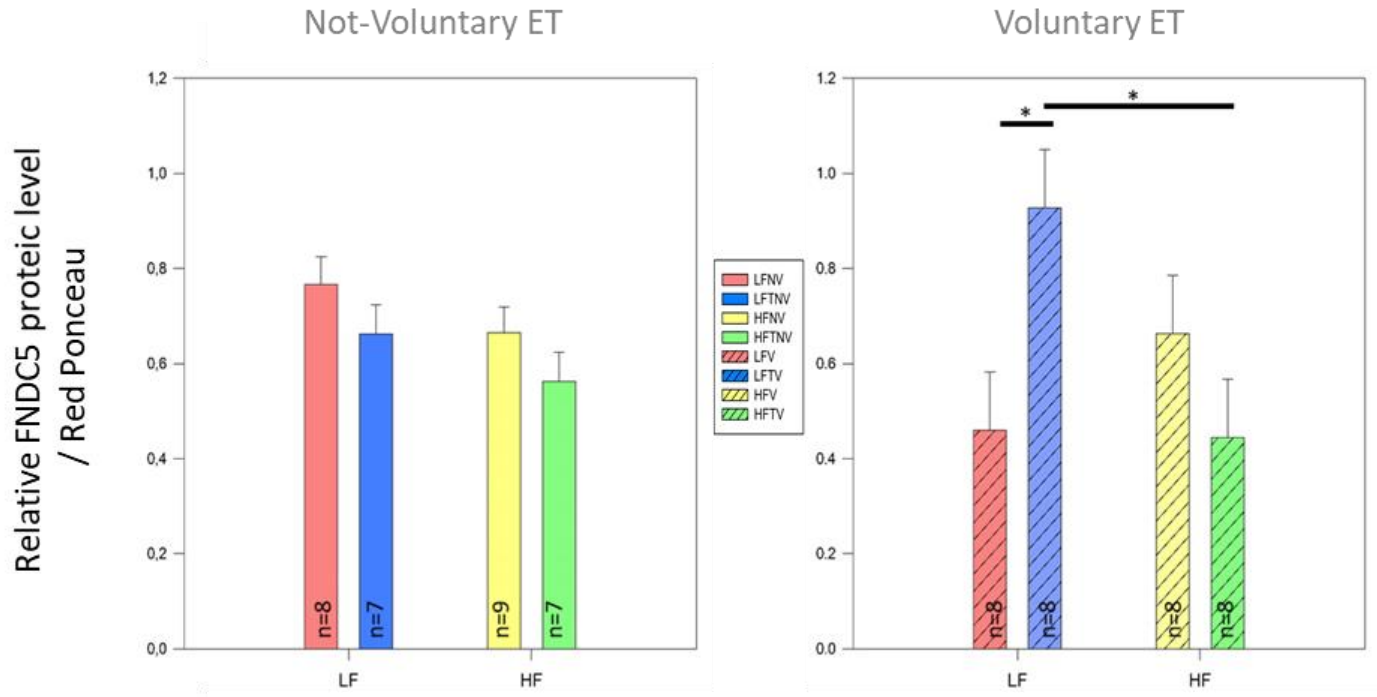


After Training



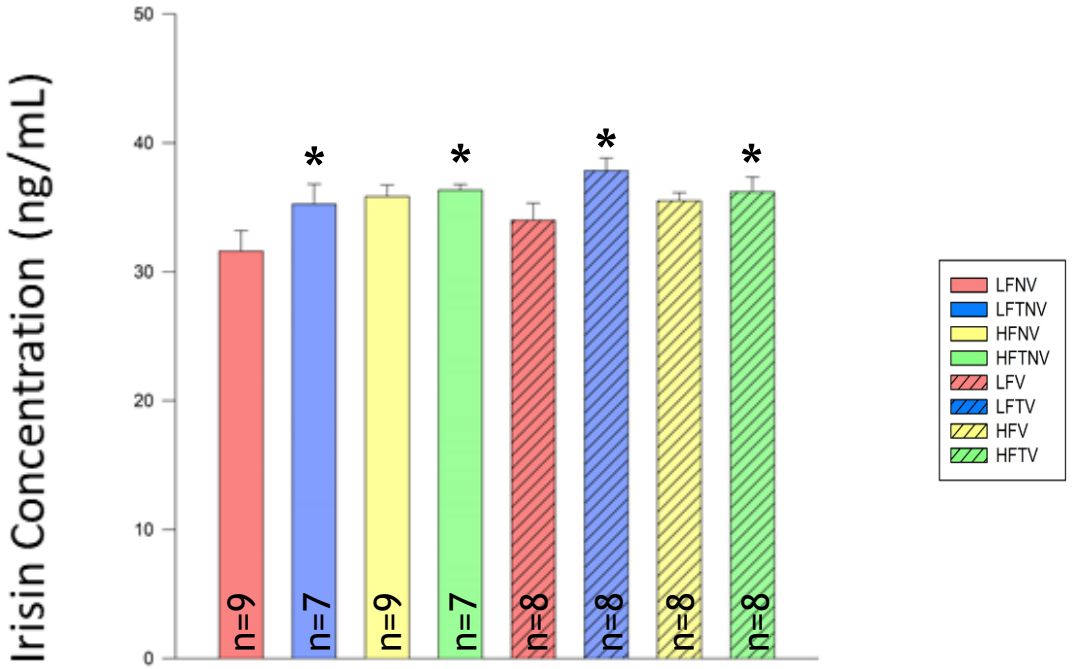
One Way ANOVA, *** : p < 0,001 ; ** : p = 0,002 ; * : p < 0,05

In muscle, the increase of FNDC5 protein level associated to voluntary exercise is inhibited by obesity



Two Way ANOVA, * : p < 0,05

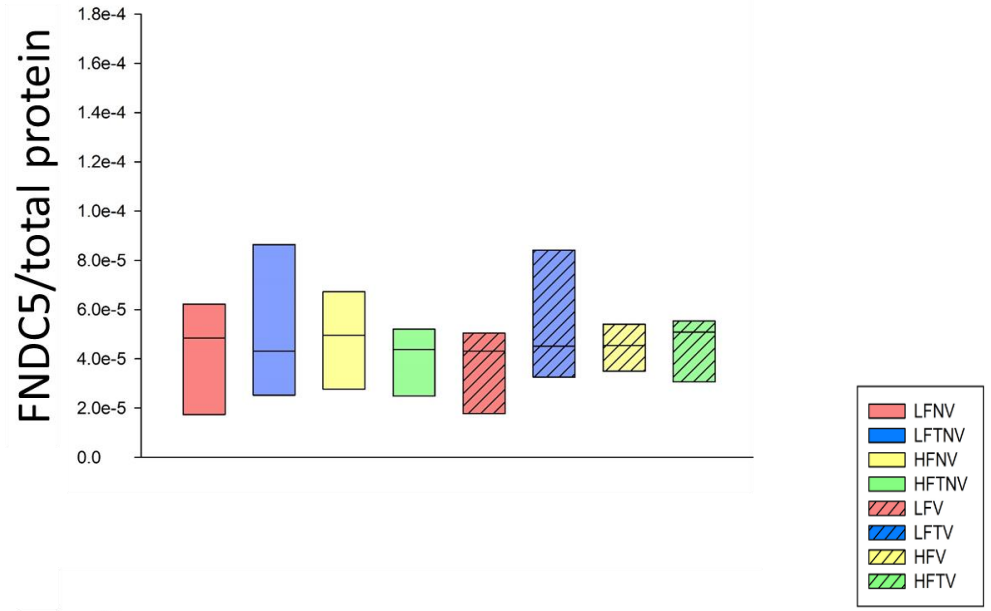
Exercise training increases Irisin plasmatic level



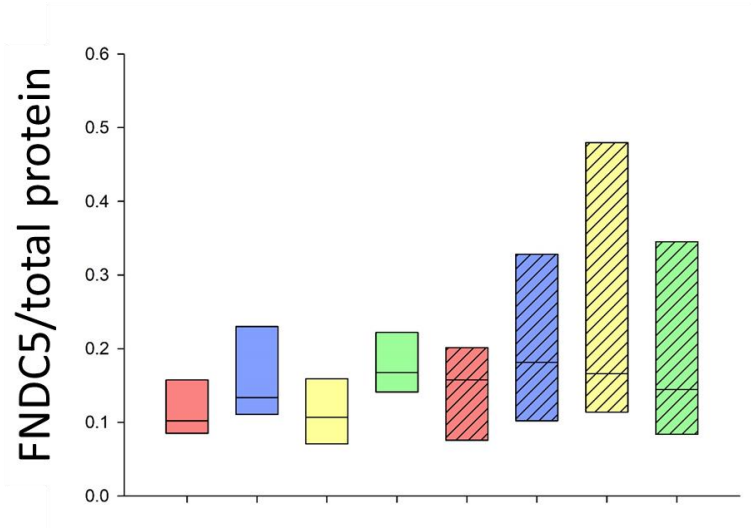
Three Way Anova, * p = 0,008 T Vs UT

In brain, FNDC5 protein level is not modified by exercise or HF diet

Brain cortex

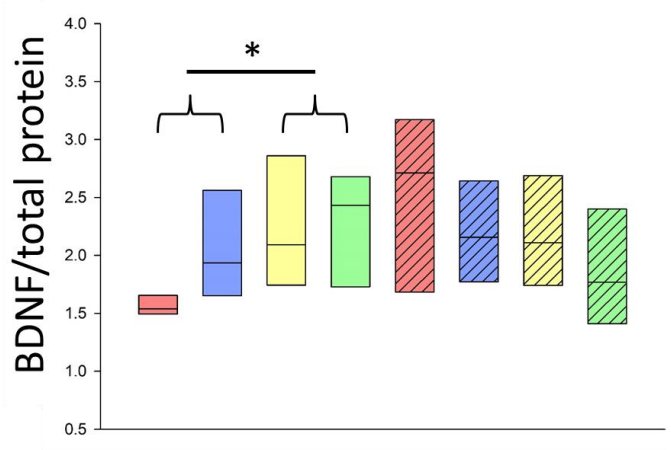


Hippocampus

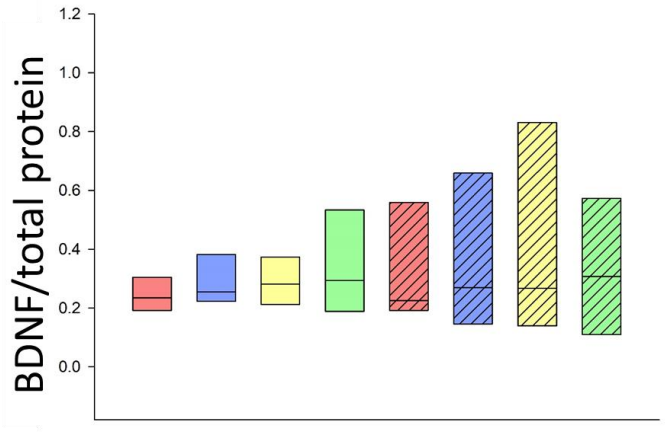


In Not-Voluntary trained mice, BDNF protein level is increased by exercise and HF diet in brain cortex but not in the hippocampus

Brain cortex

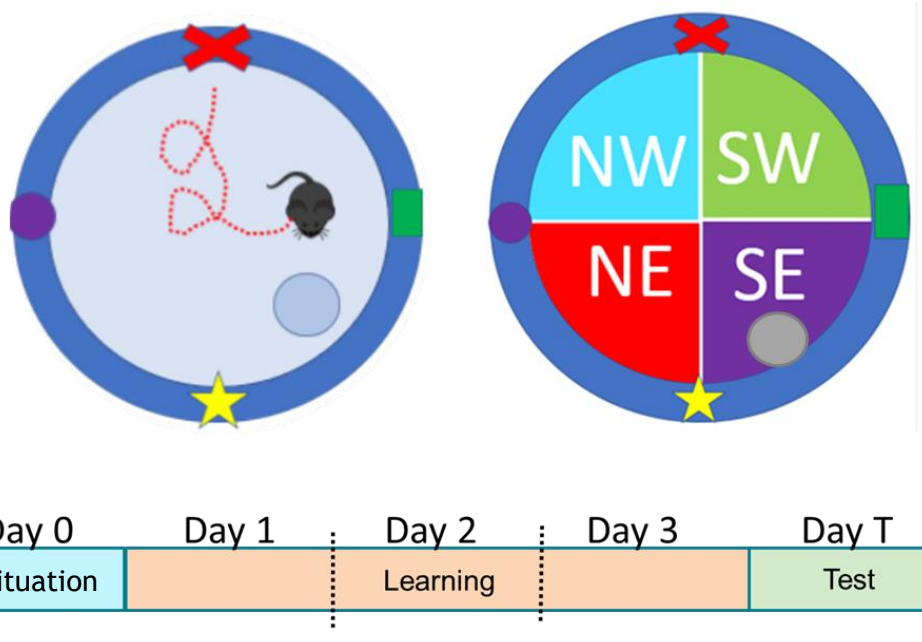


Hippocampus



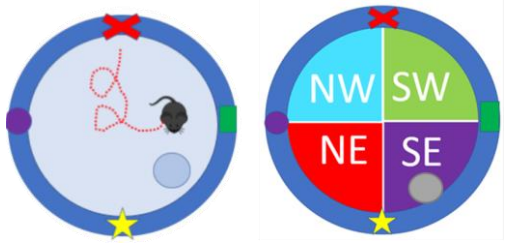
Three Way ANOVA, B. * : p < 0,05 and p < 0,05 T Vs UT in NV

Evaluation of spatial learning and memory

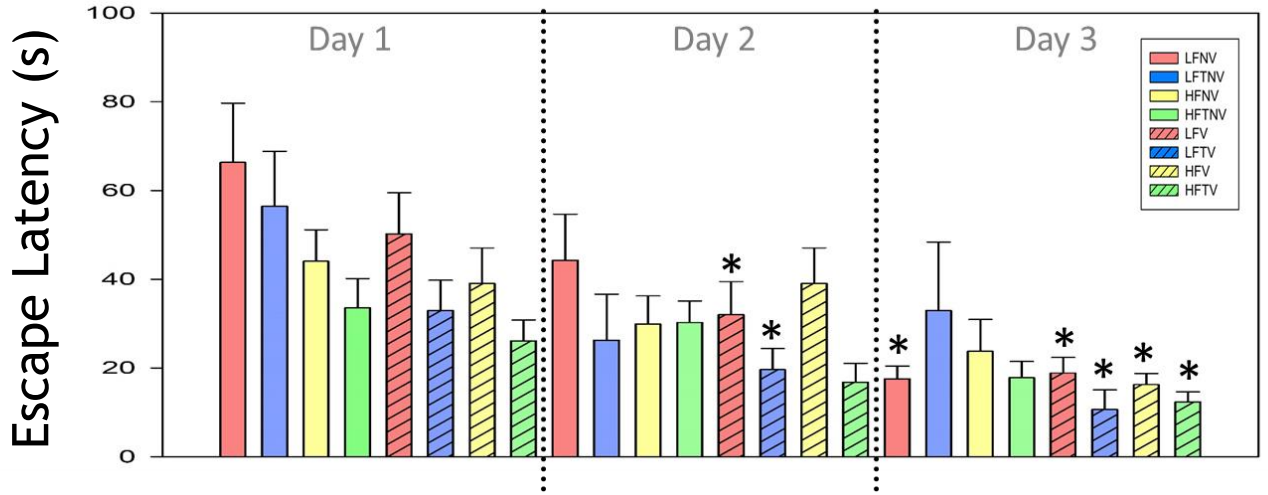


Morris Water Maze

The enrichment applied in Voluntary trained mice improves spatial learning and memorization

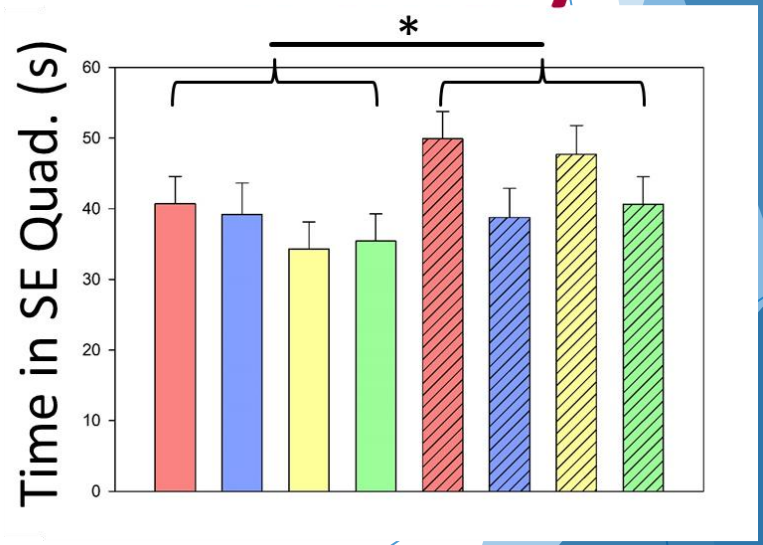


Learning



One Way ANOVA on Repeated Measures, * p < 0,05

Memory

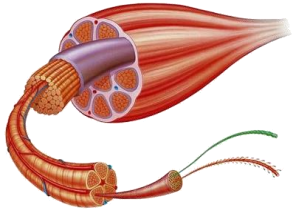


Three Way ANOVA,* p < 0,05

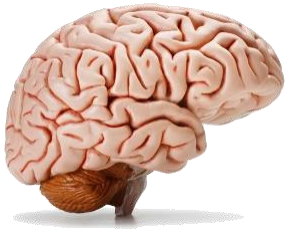
Conclusion and take home message

ET in mice increases **Irisin** plasmatic level.

FNDC5 protein level <u>in skeletal muscle</u> depends on training modalities and is influenced by diet:
-only voluntary ET induces FNDC5 protein expression.
-this effect is impaired in obese mice.



FNDC5 protein level <u>in the brain cortex and hippocampus</u> are not modified by ET or diet.



Enrichment, *per se*, improves **spatial learning and memory**.
This effect is not associated to BDNF expression changes in the hippocampus.
BDNF protein level in the cortex is influenced by ET and diet in Not-Voluntary groups.

→ **Differential regulation of FNDC5 expression and cleavage into Irisin according to ET modalities and diet.**

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