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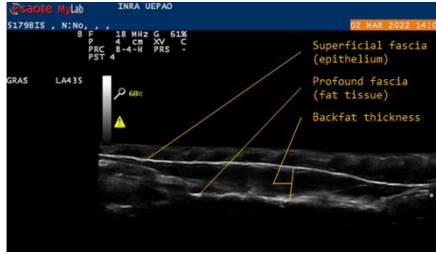
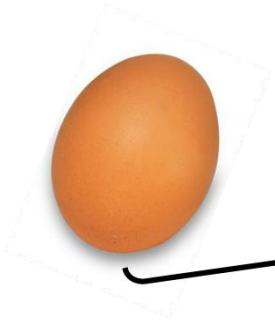
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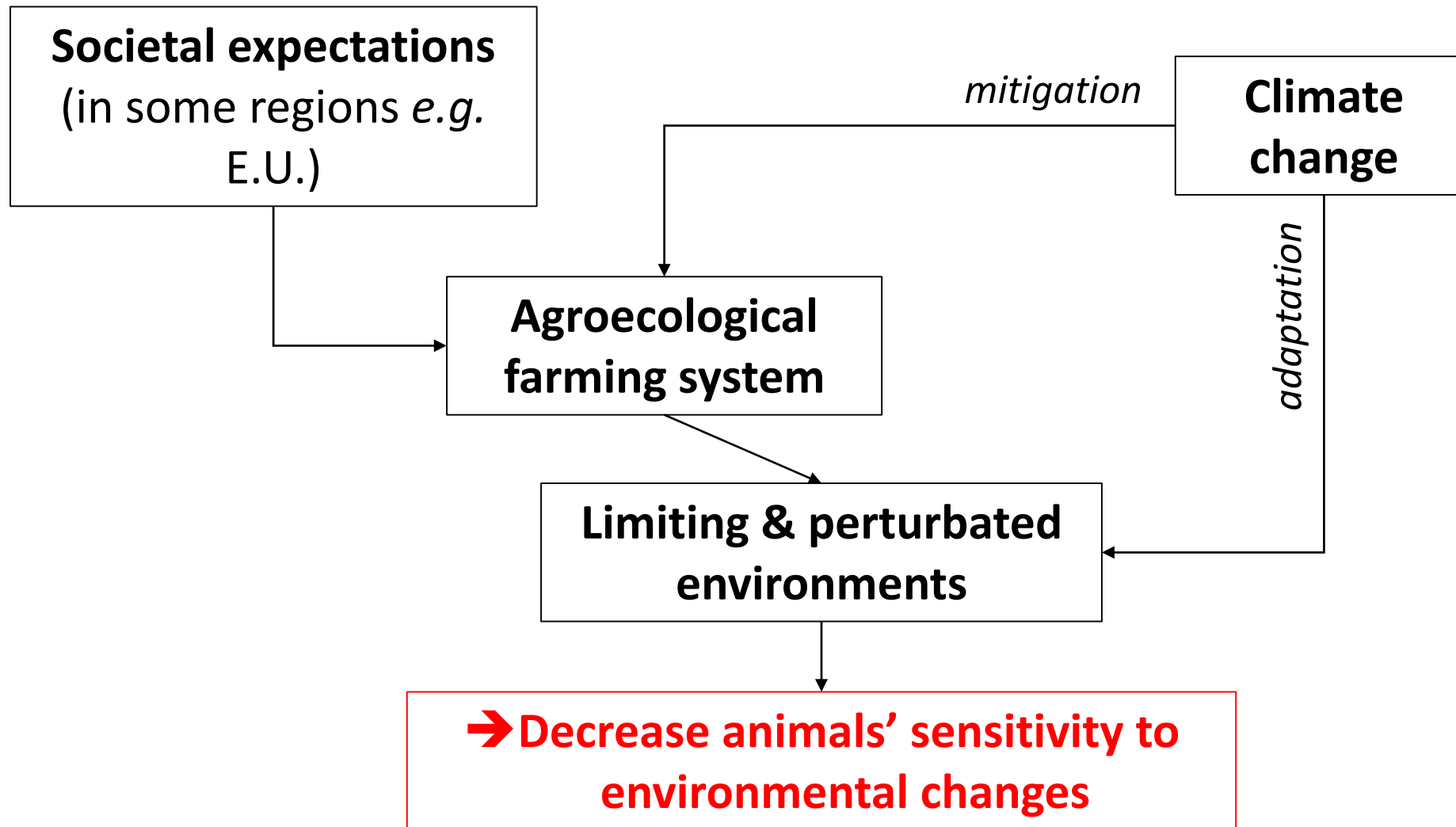


## ➤ The Life-Functions Ratio: a new indicator trait of trade-offs to go beyond genetic correlations

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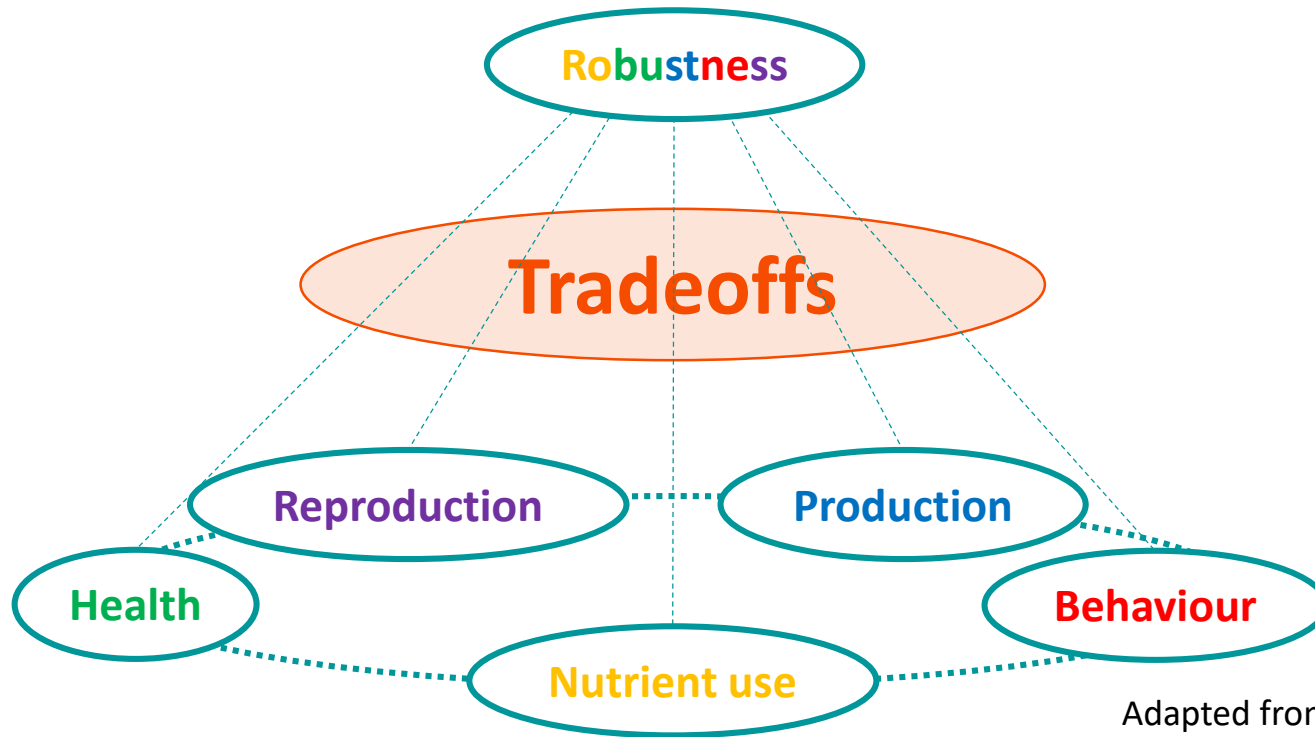
## ➤ Animals need to cope with environmental perturbations



## ➤ Acting on tradeoffs to improve robustness

A way to look at environmental sensitivity = Robustness:

**multi-performance** in multiple environments



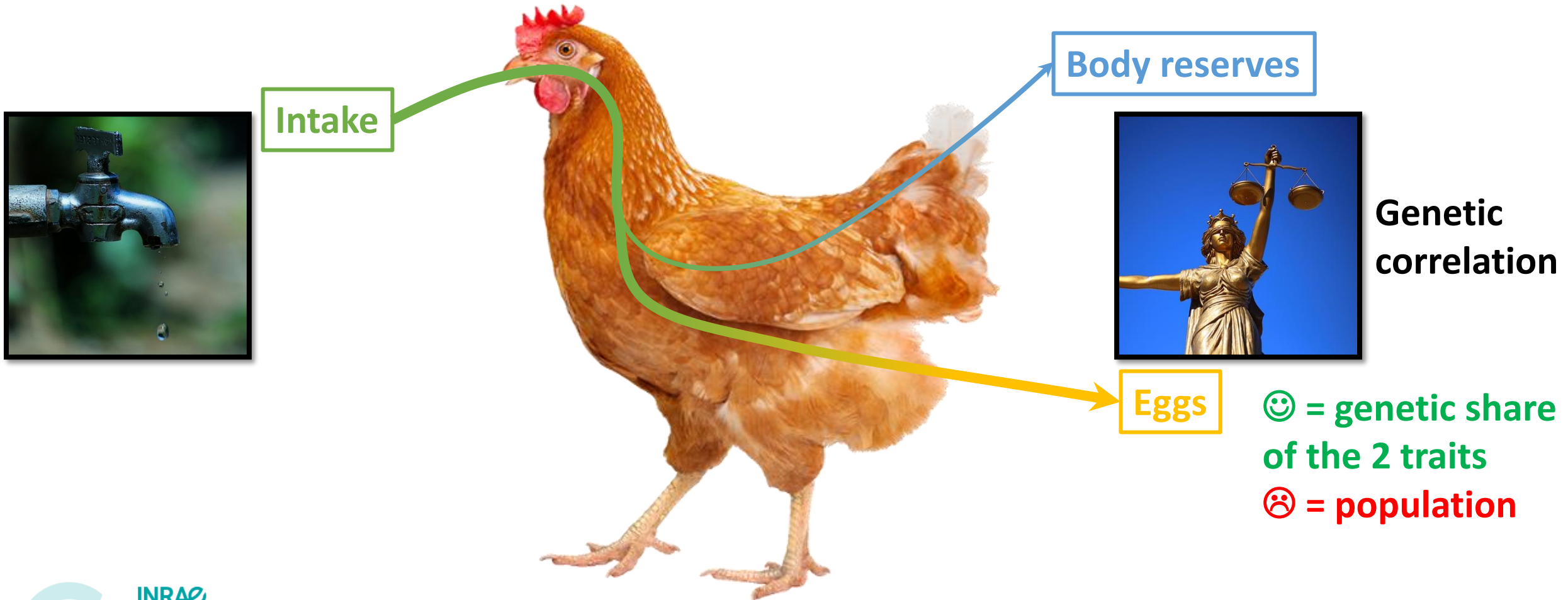
Adapted from [Friggens et al. \(2017\)](#)

➔ Genetic improvement of multi-performance:

- selection index
- global criterion (e.g. functional longevity)
- **tradeoff**

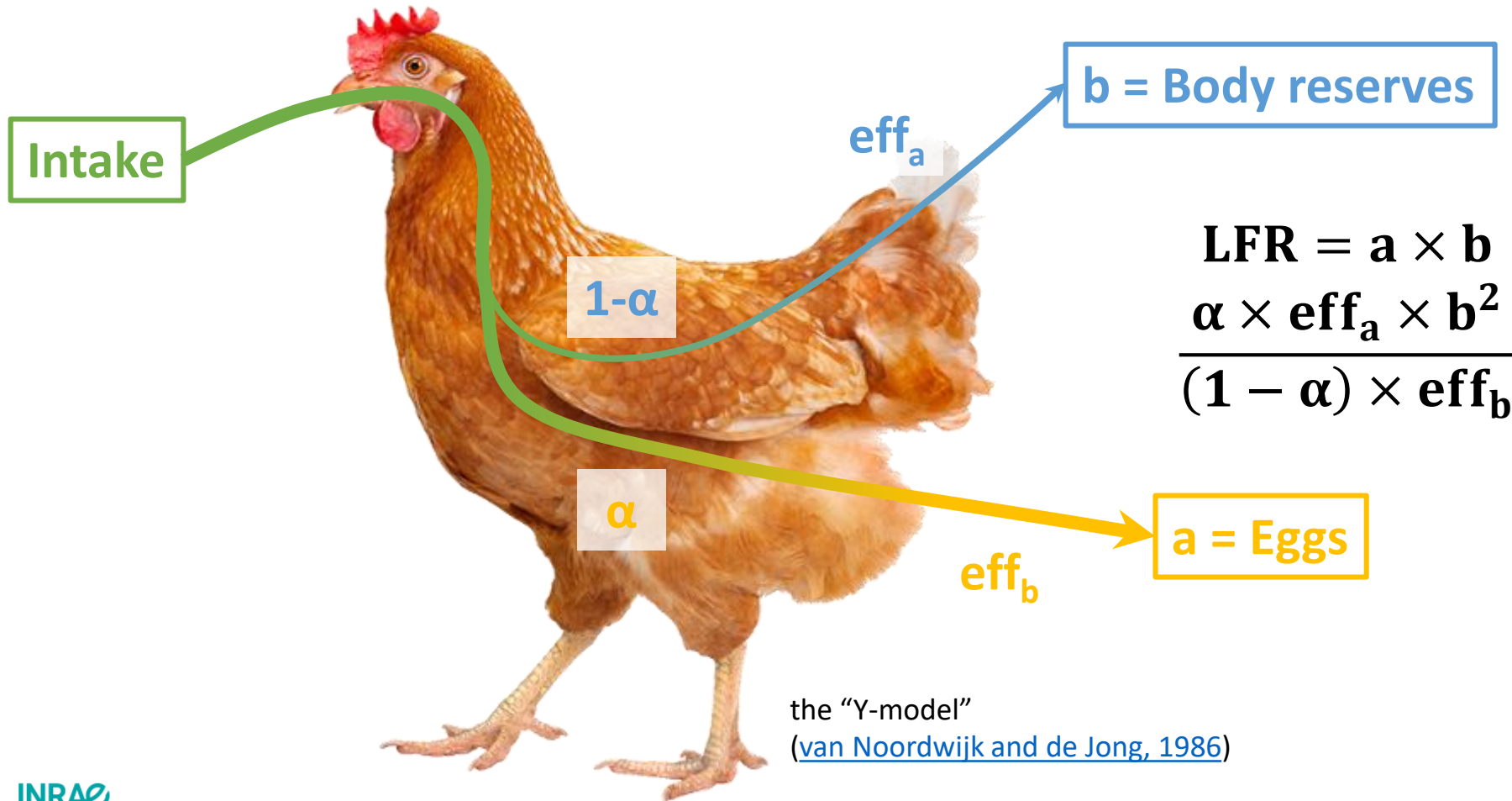
## ➤ What is a tradeoff?

Difficult question! Depends a lot on the scale (cell to regions) and on the field (genetics to economics).  
A collective expertise in INRAE (Network Compromis, Metaprogram SANBA) confirmed.



## ➤ Tradeoff and resource acquisition and allocation

Difficult question! Depends a lot on the scale (cell to regions) and on the field (genetics to economics).  
A collective expertise in INRAE (Network Compromis, Metaprogram SANBA) confirmed.



➤ Questions !

AND

Answers ?

What is the genetic architecture of tradeoff between eggs and body reserves?

- Genetic parameters

$$h^2 = 0.31$$

- QTL detection

**We identified 3 QTLs**

What is the genetic relationship between tradeoff, allocation, and the original traits?

**LFR was highly correlated with original traits ( $r_g > 0.60$ )**

**LFR was little correlated with  $\alpha$  ( $r_g = 0.02$ )**



**INRAE**

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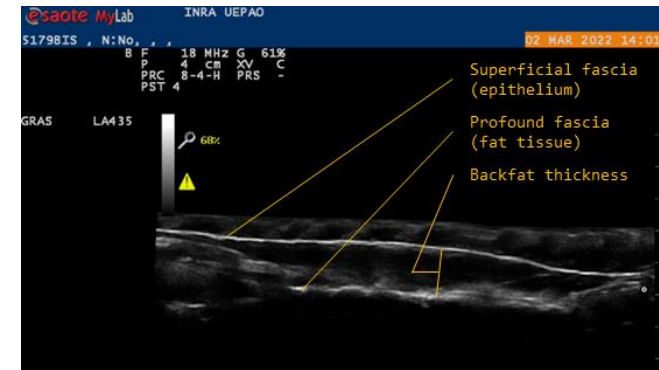
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## ➤ Materials



### Rhode Island line of Novogen (Nucleus + experimental supplement):

- 3 related batches from 2020 to 2022 (n=2,016 hens)
- Genotyped with a 60k SNP bedchip
- Phenotypes recorded (80 wks of age):
  - Egg Number
  - Backfat thickness (ultrasonography)
- Phenotype calculated : LFR



**LFR**



## ➤ Methods

### Variance components estimation with ASREML 4.2:

- Fixed effect of the batch
- Random effects: additive genetic effect (pedigree relationship matrix) and residuals

### GWAS with Muller:

Same model with:

- BLUP (fixed additive genetic variance)
- Additional fixed effect: SNP (regression)



## ➤ Genetic parameters

	$\alpha$	LFR	Backfat	Eggs
$\alpha$	<b>0.18 (0.05)</b>			
LFR	-0.02 (0.20)	<b>0.31 (0.07)</b>		
Backfat	-0.63 (0.13)	0.78 (0.07)	<b>0.44 (0.07)</b>	
Eggs	0.59 (0.13)	0.62 (0.11)	0.12 (0.18)	<b>0.13 (0.04)</b>

LFR displayed:

- Moderate heritability ➔ room for genetic improvement
- Highly correlated with backfat and eggs ➔ good tradeoff trait
- Not correlated with allocation coefficient ➔ LFR and  $\alpha$  relate to different aspects of tradeoff



# ➤ Genome Wide Association Study

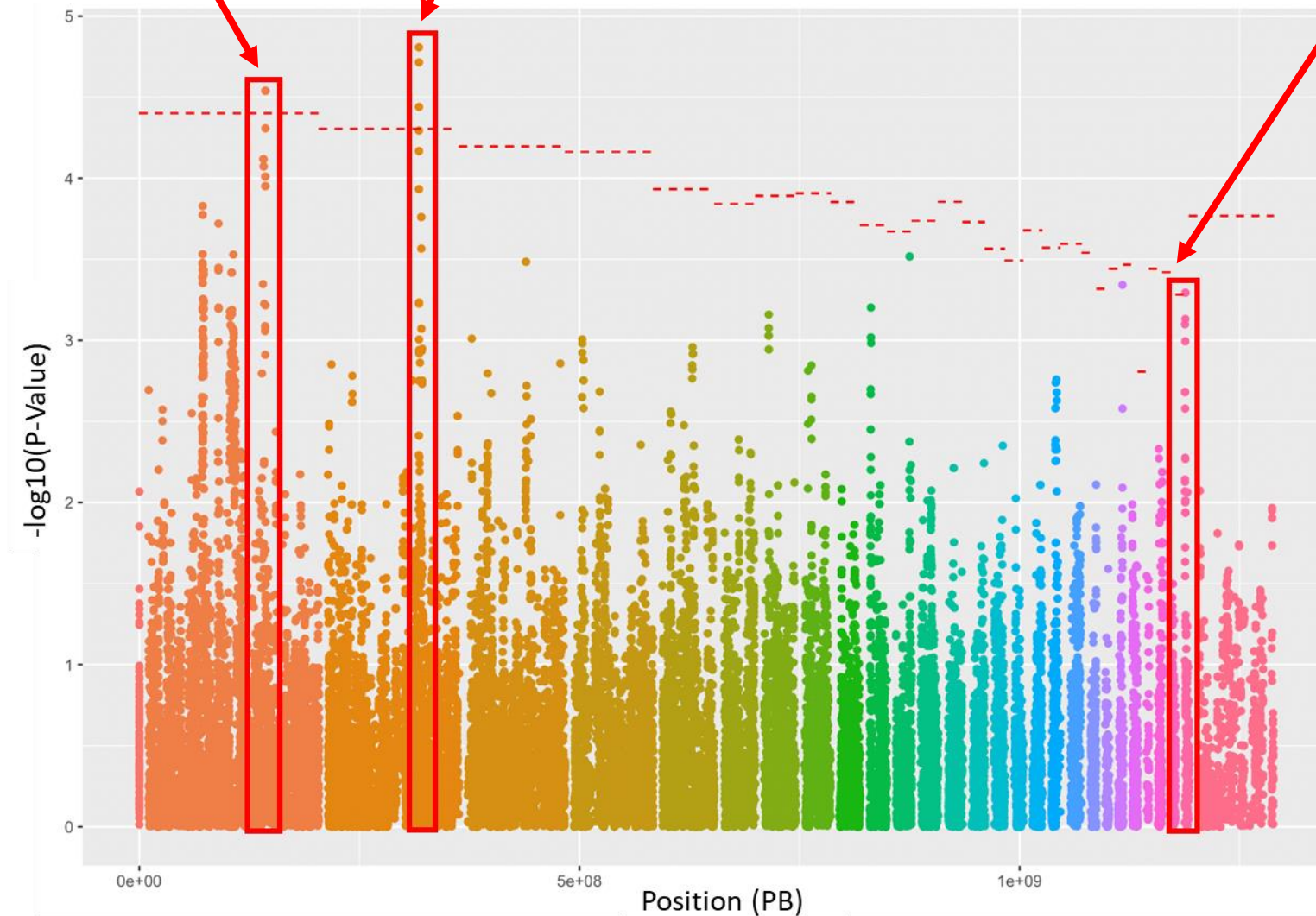
**Carbohydrate sulfotransferase 10**

energy metabolism  
oestrogens

**Long non coding RNA**

**RAN bind protein 3**

energy metabolism



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## ➤ Thanks for your attention



### What is the genetic architecture of tradeoff between eggs and body reserves?

- Moderate heritability (0.31) ➔ room for genetic improvement
- Highly correlated with backfat and eggs ➔ good tradeoff trait

### What is the genetic relationship between tradeoff, allocation, and the original traits?

- Not correlated with allocation coefficient ➔ LFR and  $\alpha$  relate to different aspects of tradeoff