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# BLOOD ANALYSIS PARAMETERS GENETICALLY ASSOCIATED WITH LONGEVITY OF JUMPING HORSES

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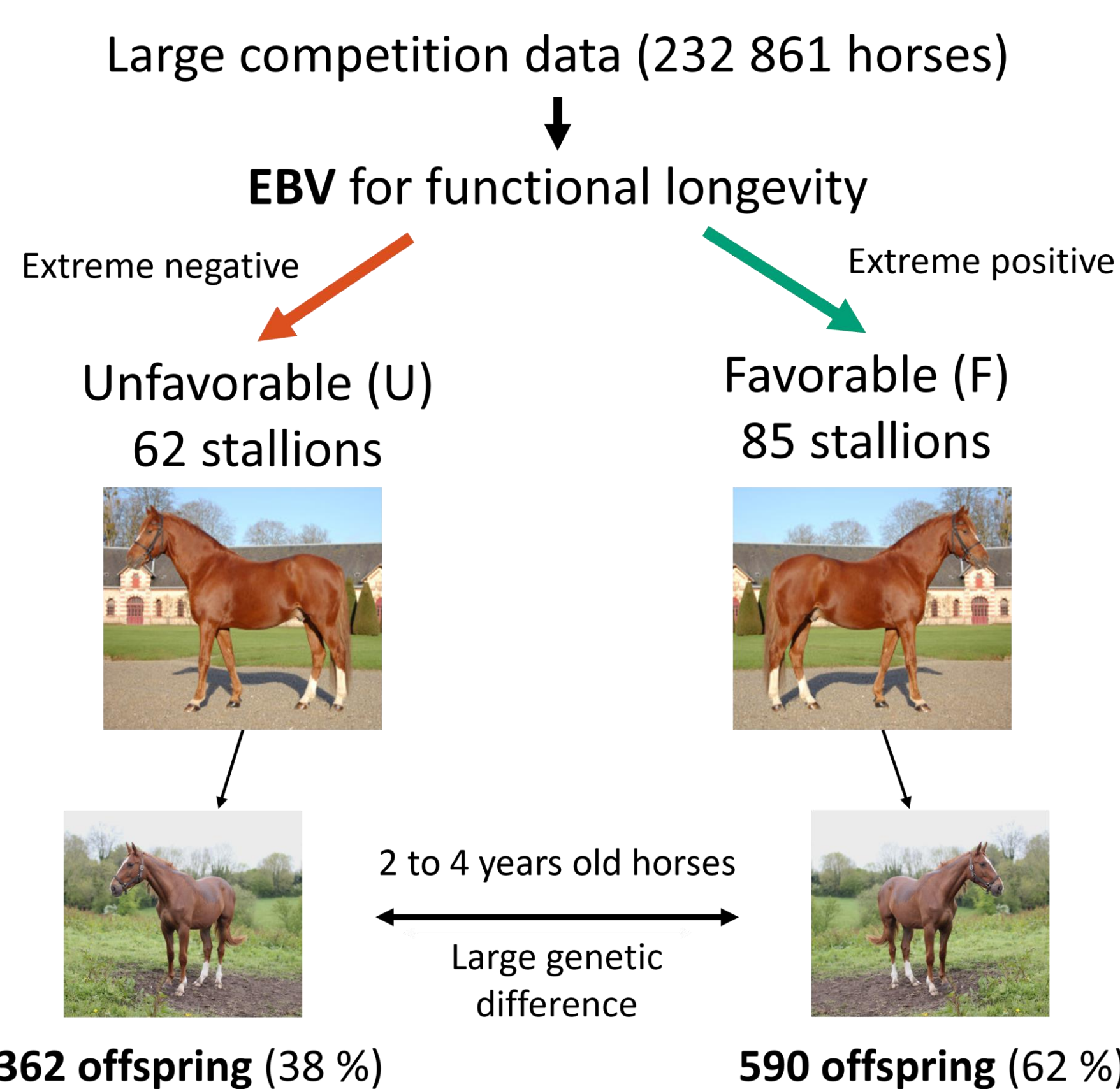
The project aims to find criteria genetically associated with **functional longevity** of sport horses, defined as the time spent in competition corrected for the level of performance.

A specific protocol has been set up to measure new phenotypes, including blood parameters, in young horses prior to their competition career, sired from stallions with extreme functional longevity.

## MATERIALS & METHODS

### DATA - 2018 to 2022

Blood samples were taken from **952 Selle Français**  
**59 blood parameters** were measured



### 8 groups of parameters :

- Bone and joint
- Cytokine
- Endocrinology
- Hematology (red blood cells, white blood cells)
- Kidney function
- Liver function
- Oxidative stress
- Protein

### METHOD

1. Estimation of the heritability of each variable (y) using an univariate mixed model.

$$y = Xb + Zu + e$$

$$V(u) = A\sigma_u^2$$

$u$  is the vector of random animal additive genetic value  
 $A$  is the relationship matrix constructed from ancestors up to 6 generations ( $n=10,280$ )

2. New standardised variables corrected for fixed effects : age, sex, weight, date and place ( $X\hat{b}$ ).

$$y_c = y - X\hat{b}$$

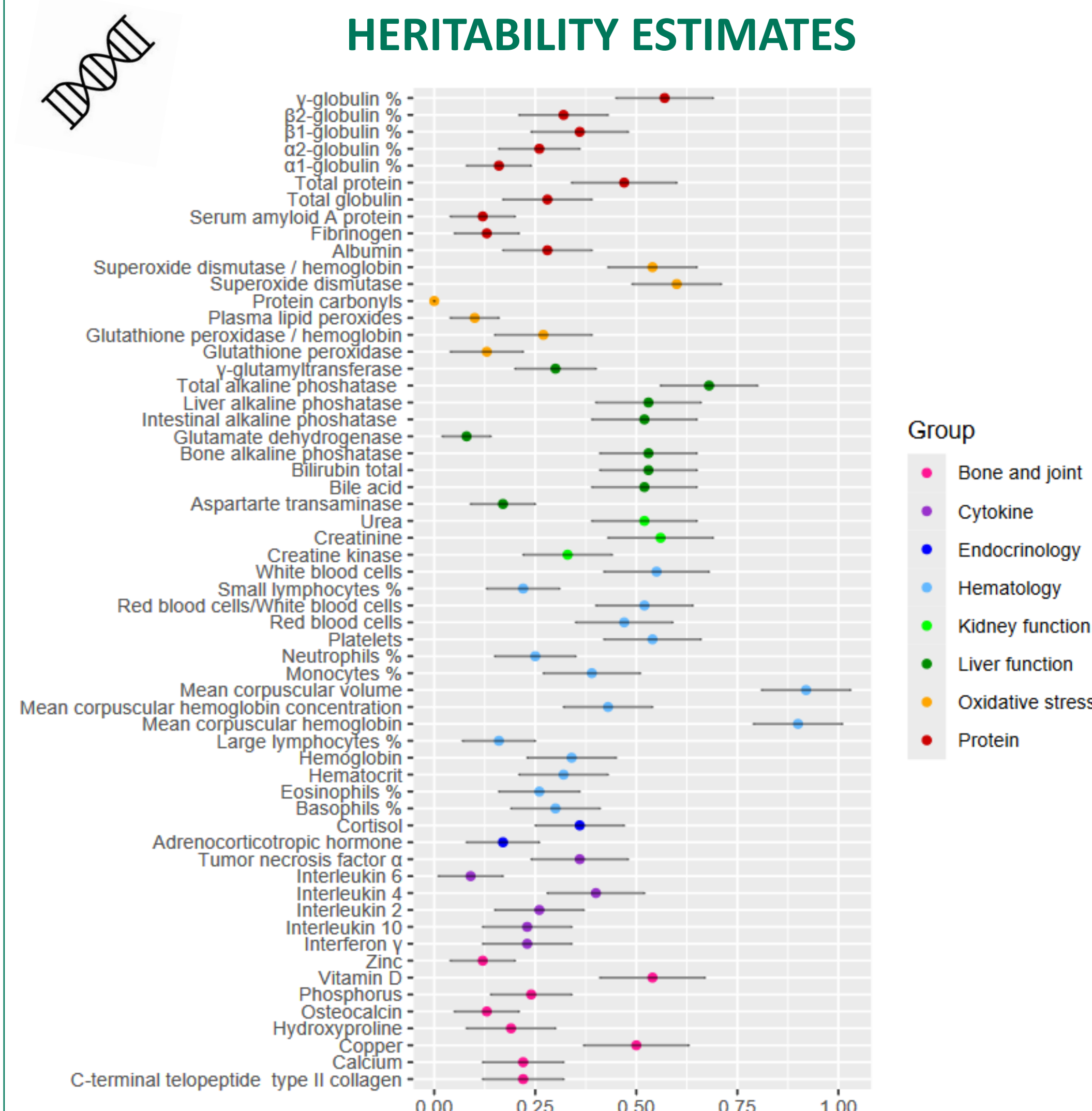
3. Partial Least Square logistic regression to predict the sire group (U or F).

$$g(\theta)_i = \sum_{h=1}^H \left( c_h \sum_{j=1}^p w_{jh} y_{ij}^* \right)$$

$g$  is the logit link-function  
 $i$  is the horse,  $p$  is the number of variable  
 $H$  is the number of components,  $w_{jh}$  is the coefficient of the predictor  $j$  for the component  $h$   
 $c_h$  is the coefficient of each component  $h$

## RESULTS AND DISCUSSION

### HERITABILITY ESTIMATES



- **Effects of age, sex, visit and weight on several variables :** relevance of their inclusion in the final model.
- **Phenotypic correlations** were found within functions - some high - but not between functions.
- **High heritability estimates :** 30% greater than 0.5 but **possible surestimation** due to the nature of the sample : progeny of extreme stallions for longevity EBV.
- **Significant results for the logistic regression**
- **No pre-existing studies** on this question.

### FUNCTIONAL LONGEVITY

Group	Variable	Effect	Estimated regression coefficient	P-value
Kidney function	Creatine kinase	Negative	-0.06	< 0.05
	α1-globulin %	Positive	0.10	< 0.05
	α2-globulin %	Positive	0.17	< 0.001
Protein	β1-globulin %	Negative	-0.12	< 0.01
	Total protein	Positive	0.03	< 0.05
	Liver alkaline phosphatase %	Negative	-0.05	< 0.01
Liver function	Intestinal alkaline phosphatase %	Positive	0.11	< 0.01
	Bone alkaline phosphatase %	Positive	0.03	< 0.01
	Total alkaline phosphatase	Negative	-0.05	< 0.01
Hematology	Hemoglobin	Negative	-0.07	< 0.05
	Hematocrit	Negative	-0.06	< 0.05
	RBC/WBC	Positive	0.13	< 0.05
	Mean corpuscular hemoglobin	Negative	-0.19	< 0.001
	Mean corpuscular volume	Negative	-0.16	< 0.001
	White blood cells	Negative	-0.09	< 0.01
Monocytes %	Negative	-0.11	< 0.05	

## CONCLUSION

Potentially, 16 heritable blood parameters taken at rest on young horses have a genetic correlation with the functional longevity in jumping competition. Four groups of parameters are concerned : hematology, protein, kidney function and liver function. However, there is little information on these subjects in the literature to compare our results.