

# Valoración genética

**ASIGNATURA: MEJORA GENÉTICA VEGETAL Y ANIMAL**  
**GRADO EN BIOTECNOLOGÍA**

**Manuel Ramón Fernández – [Manuel.Ramon@uclm.es](mailto:Manuel.Ramon@uclm.es)**

# Fenotipo, genotipo y ambiente

Fenotipo

Ambiente

$$P = G + E + G \times E$$

Genotipo

Interacción GxE

The diagram illustrates the equation for phenotype (P) as the sum of genotype (G), environment (E), and their interaction (G x E). The terms are visually distinguished: P is in a blue circle, G is in a red circle, E is in a teal circle, and G x E is in a red oval. Arrows point from each term to its corresponding label: P to 'Fenotipo', G to 'Genotipo', E to 'Ambiente', and G x E to 'Interacción GxE'.

# Modelo animal

$$y = Xb + Zu + e$$

In the Mixed Model Equation form:

$$\begin{bmatrix} X^T X & X^T Z \\ Z^T X & Z^T Z + A^{-1} \alpha \end{bmatrix} \begin{bmatrix} b \\ u \end{bmatrix} = \begin{bmatrix} X^T y \\ Z^T y \end{bmatrix}$$

where 'A' is an additive relationship matrix and alpha is a ratio of the variance components. It can also be written as:

$$\text{LHS} \cdot B = \text{RHS}$$

# Modelo animal

Relaciona efectos fijos con datos

Relaciona efectos fijos con individuos

Soluciones= coeficientes de los efectos fijos (b) y valores genéticos (u)

$$\begin{bmatrix} \boxed{X^T X} \\ \boxed{Z^T X} \end{bmatrix} \begin{bmatrix} \boxed{X^T Z} \\ \boxed{Z^T Z} + \boxed{A^{-1} \alpha} \end{bmatrix} \begin{bmatrix} \boxed{b} \\ \boxed{u} \end{bmatrix} = \begin{bmatrix} X^T y \\ Z^T y \end{bmatrix}$$

Relación de individuos del pedigrí

Matriz de relaciones genéticas aditivas y relación de varianzas

# Ejercicio

## Actividades

### 3.2 A Model for an Animal Evaluation (Animal Model)

*Example 3.1*

Consider the following data set (Table 3.1) for the pre-weaning gain (WWG) of beef calves.

The objective is to estimate the effects of sex and predict breeding values for all animals. Assume that  $\sigma_a^2 = 20$  and  $\sigma_e^2 = 40$ ; therefore  $\alpha = \frac{40}{20} = 2$ .

**Table 3.1.** Pre-weaning gain (kg) for five beef calves.

Calf	Sex	Sire	Dam	WWG (kg)
4	Male	1	Unknown	4.5
5	Female	3	2	2.9
6	Female	1	2	3.9
7	Male	4	5	3.5
8	Male	3	6	5.0

The model to describe the observations is:

$$y_{ij} = p_i + a_j + e_{ij}$$

where:  $y_{ij}$  = the WWG of the  $j$ th calf of the  $i$ th sex,  $p_i$  = the fixed effect of the  $i$ th sex,  $a_j$  = random effect of the  $j$ th calf, and  $e_{ij}$  = random error effect. In matrix notation the model is the same as that described in equation [3.1].