Quantitative Genetics - Multiple Loci

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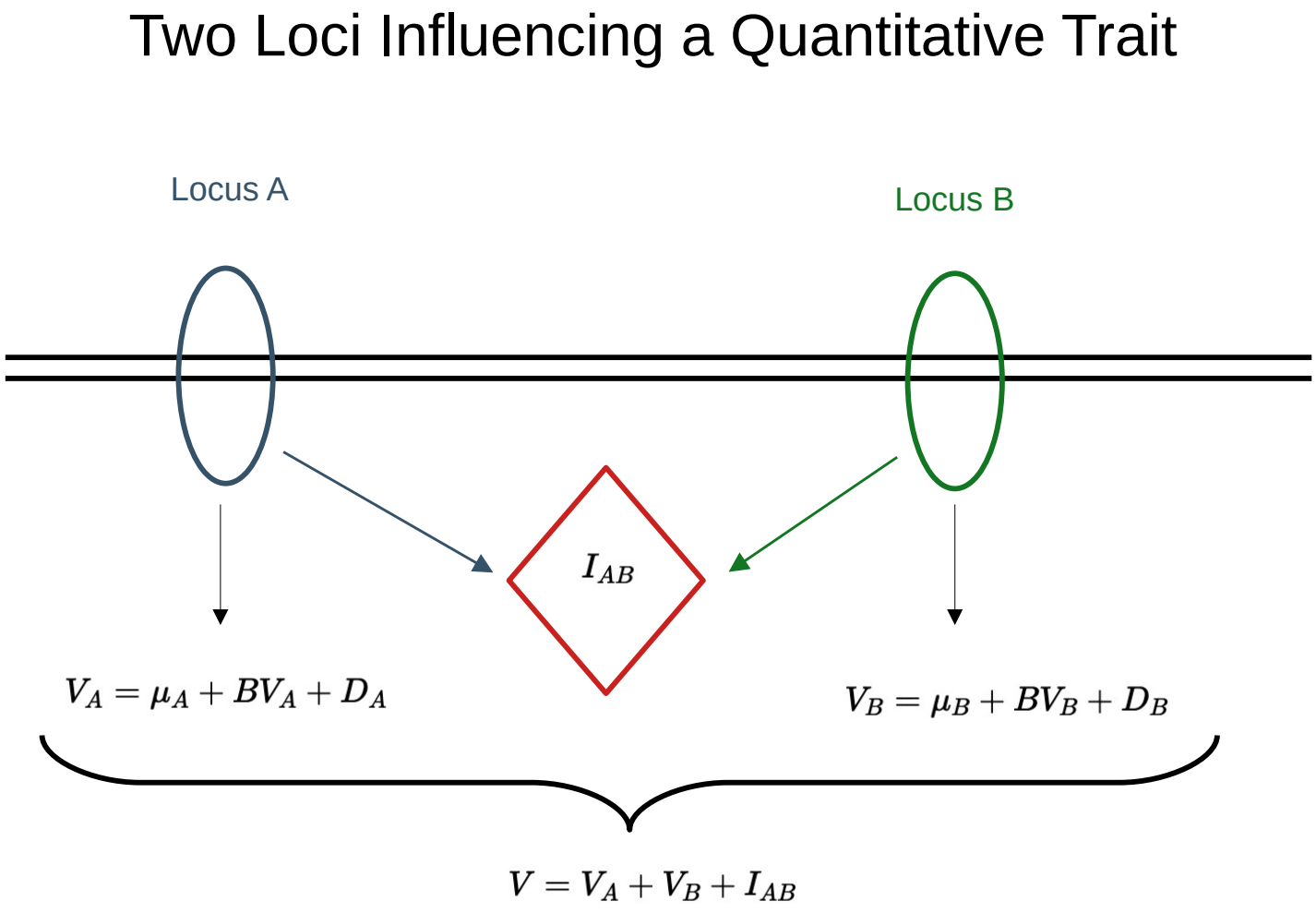
Two and more Loci

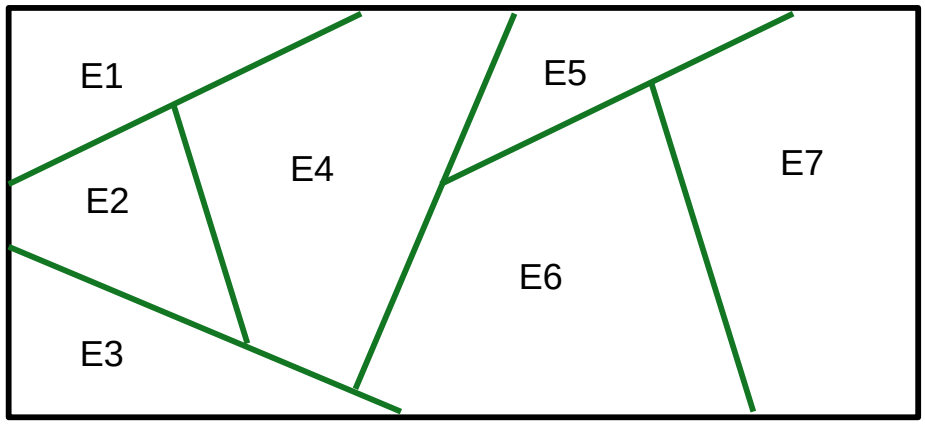
- Two loci A and B having an effect on the same quantitative trait.
- Additional effect in genetic model: **Interaction** effect (also known as epistasis)
- Interaction occurs if effect of one locus can have an influence on the effect of the other locus
- Interaction is quantified by

$$I_{AB} = V - V_A - V_B$$

Influence of Two Loci on Quantitative Trait



Quantify Interaction Effect

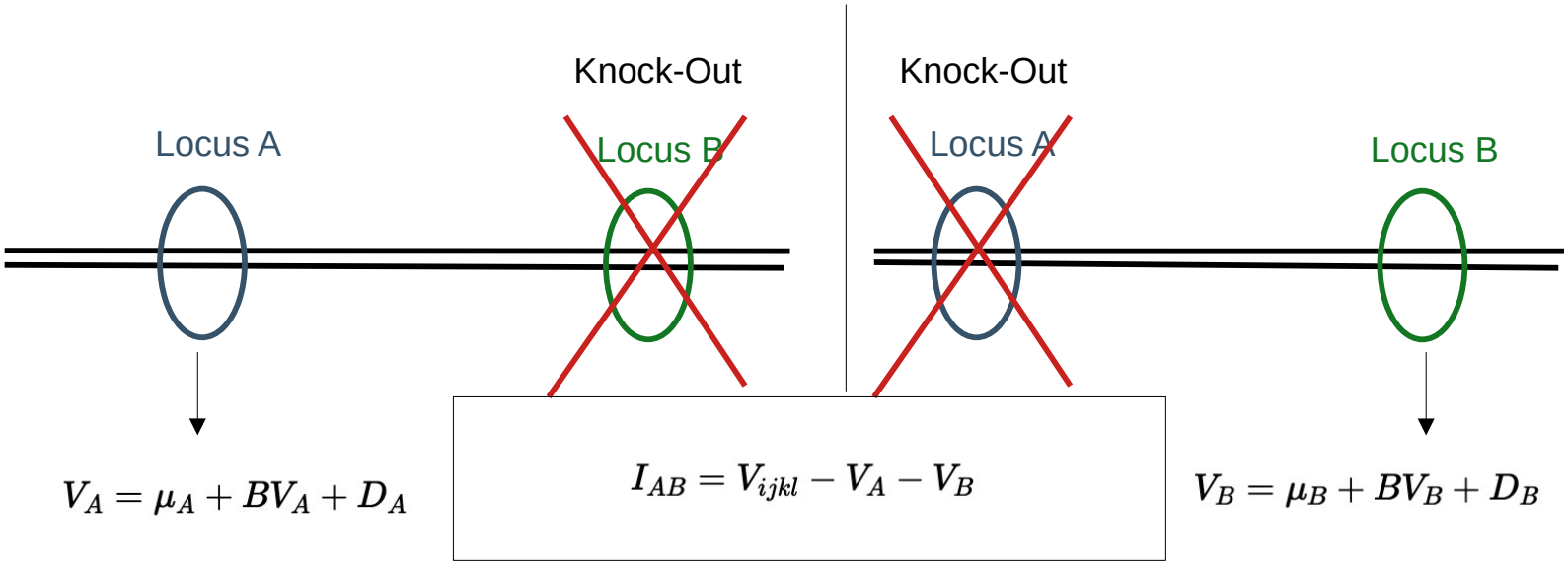


For Animal d with genotype:

$A_i A_j B_k B_l$

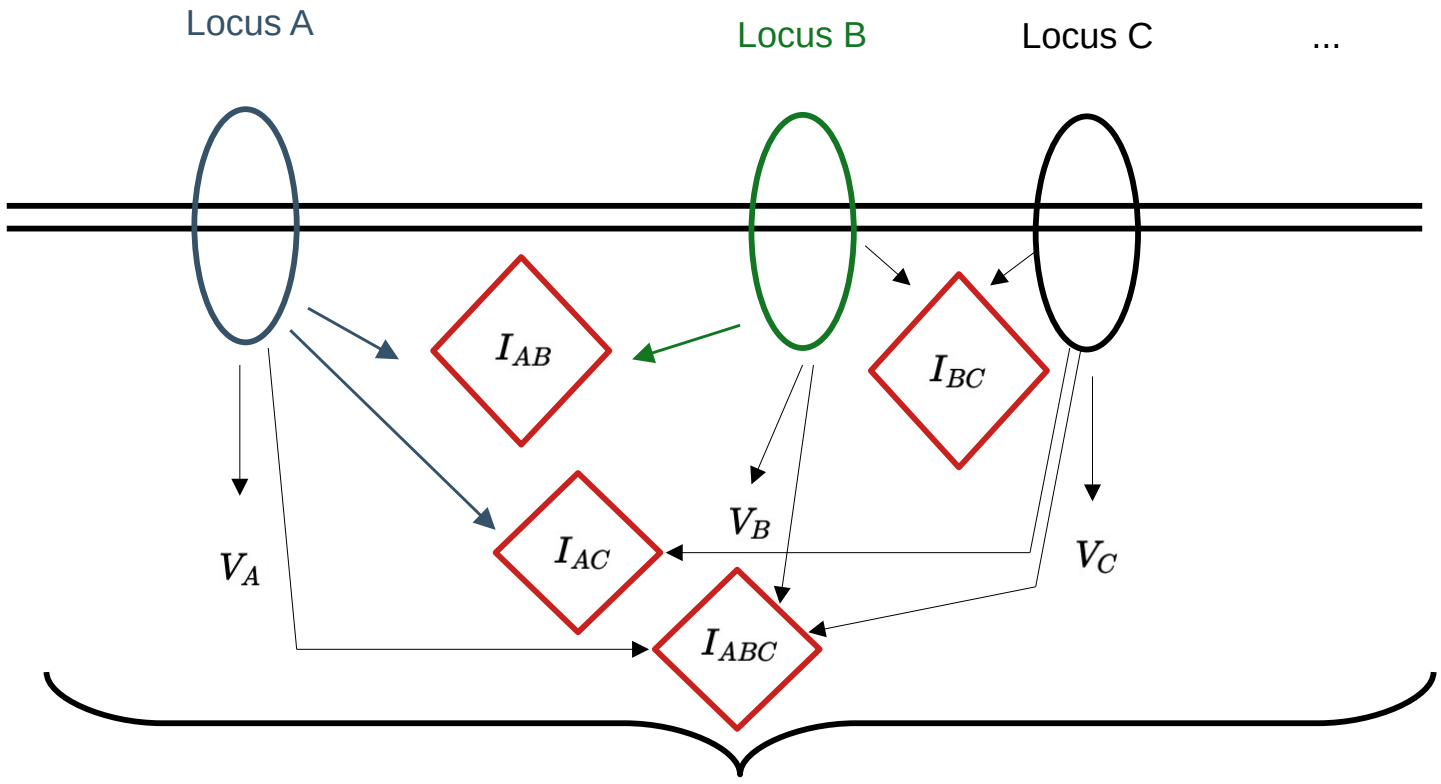
Total Genetic Value V_{ijkl}
as mean phenotypic value (Y)
accross different environments
(E1 to E7):

$$V_{ijkl} = \frac{1}{N} \sum_{m=1}^{N} Y_{ijklm}$$



More Than Two Loci

Many Loci Influencing a Quantitative Trait



$$V = V_A + V_B + V_C + \ldots + I_{A \cdot B \cdot C \cdot \ldots}$$

with $I_{A \cdot B \cdot C} = I_{AB} + I_{AC} + I_{BC} + I_{ABC}$

Summary

- Given genetic model

$$V = V_A + V_B + V_C + ... + I_{A \cdot B \cdot C \cdot ...}$$

- Decomposition

$$V = \mu_A + BV_A + D_A + \mu_B + BV_B + D_B + \mu_C + BV_C + D_C + ... + I_{A \cdot B \cdot C \cdot ...}$$

- Re-group

$$V = \mu_A + \mu_B + \mu_C + ... + BV_A + BV_B + BV_C + ... + D_A + D_B + D_C + ... + I_{A \cdot B \cdot C \cdot ...}$$

- Collect

$$V = \mu + BV + D + I_{A \cdot B \cdot C \cdot ...}$$