$$var(y) = var(X\beta + Zg + e) = var(X\beta) + var(Zg) + var(e)$$
$$+ 2Cov(X\underline{\beta}, Zg) + 2Cov(X\underline{\beta}, e) + 2Cov(Zg, \underline{e}) \quad \} \, 0$$

const.

$$= var(Zg) + var(e)$$
$$= Z \cdot \underbrace{var(g)}_{G \cdot \sigma_g^2} \cdot Z^T + \underbrace{var(e)}_{R = I \cdot \sigma_e^2}$$
$$= Z \cdot G \cdot Z^T \cdot \sigma_g^2 + I \cdot \sigma_e^2$$

RV

$$* \; Var(c \cdot X) = \underline{c^2 \cdot var(x)} \qquad var(5 \cdot x) = 25 \cdot var(x)$$

c: real scalar constant

Matrix-Vector: vector $g = \begin{bmatrix} g_1 \\ g_2 \\ \vdots \\ g_{10} \end{bmatrix}$ → $var(g_1)$, $var(g_2)$

$$var(g) = \begin{bmatrix} var(g_1) & cov(g_1, g_2) & \cdots \\ cov(g_2, g_1) & var(g_2) & \\ & & \ddots \end{bmatrix}$$

$$var(Zg) \overset{*}{=} Z \cdot var(g) \cdot Z^T$$

Sofar: Data sets where all animals had genotypes