□ Additional Specification / Assumptions for LME

- For each random effect, expected value and variance-covariance matrix must be specified

- Random effects are: u, e, y

$$\left.\begin{aligned} E(u) &= 0 \\ E(e) &= 0 \end{aligned}\right\} \text{ together with model } E(y) = E(X\beta + Zu + e) = X\beta$$

$$\left.\begin{aligned} \text{var}(u) &= G \\ \text{var}(e) &= R \end{aligned}\right\} \text{var}(y) = ZGZ^T + R = V$$

$$\text{cov}(u, e^T) = 0$$

$$\text{cov}(y, u^T) = ZG$$

$$\text{cov}(y, e) = R$$

(*)

$$\text{var}\begin{bmatrix} y \\ u \\ e \end{bmatrix} = \begin{bmatrix} V & ZG & R \\ GZ^T & G & 0 \\ R & 0 & R \end{bmatrix}, \quad V = ZGZ^T + R$$

$$E\begin{bmatrix} y \\ u \\ e \end{bmatrix} = \begin{bmatrix} X\beta \\ 0 \\ 0 \end{bmatrix}$$