

# Statistical Testing

## RNA-seq Statistical Methods Comparison

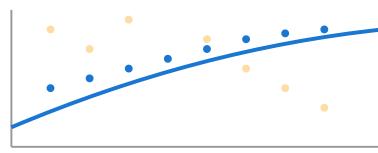
### DESeq2

$$Y \sim NB(\mu, \alpha)$$

#### Key Features:

- Shrinkage estimation of dispersion
- Size factor normalization
- Wald test / LRT

Dispersion Shrinkage



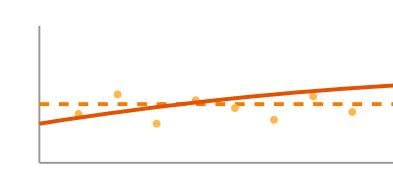
### edgeR

$$Y \sim NB(\mu, \varphi)$$

#### Key Features:

- Empirical Bayes methods
- TMM normalization
- Quasi-likelihood F-test

BCV Plot



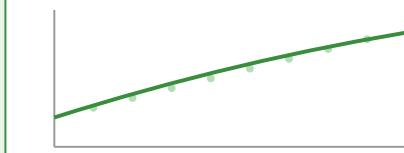
### limma-voom

$$\log(Y) \sim N(\mu, \sigma^2)$$

#### Key Features:

- Transform to log-space
- Precision weights (voom)
- Linear modeling

Mean-Variance Trend



Performance: All methods perform similarly with proper use • Choose based on experimental design and analysis goals



DESeq2 and edgeR are most widely used and well-validated