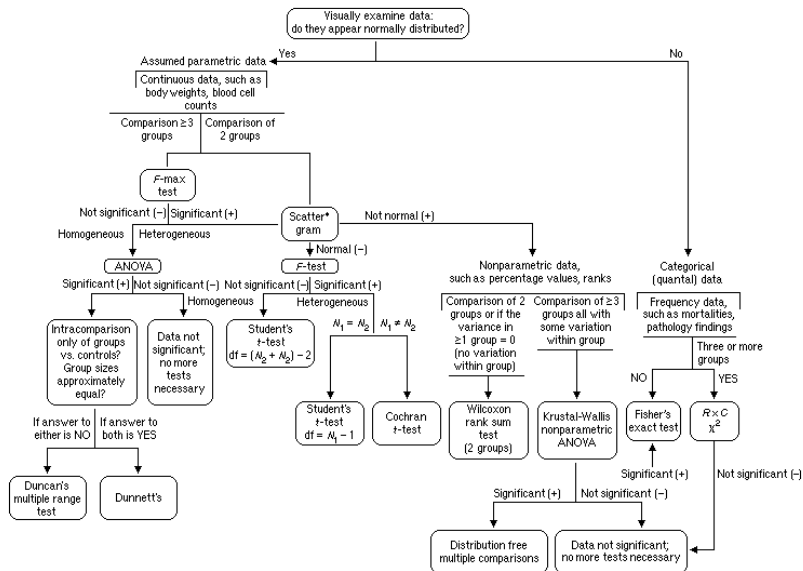
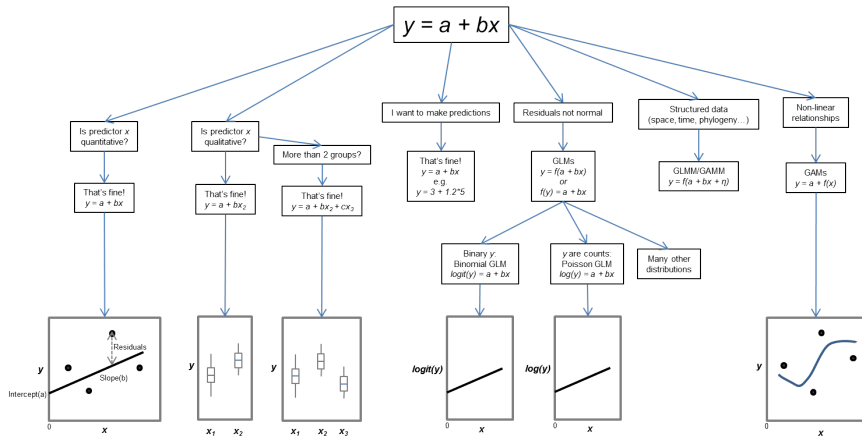


## Introduction to linear models

# Modern statistics are easier than this



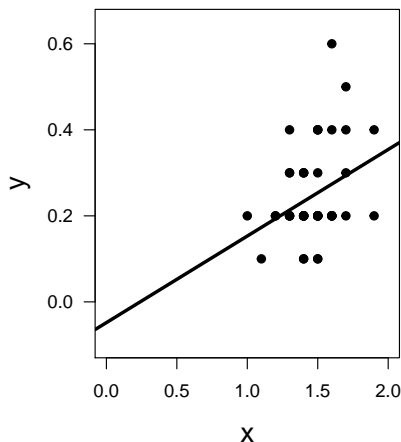
# A unified framework



# Our unified regression framework

$$y_i = a + bx_i + \varepsilon_i$$

$$\varepsilon_i \sim N(0, \sigma^2)$$



## Data

$y$  = response variable

$x$  = predictor

## Parameters

$a$  = intercept

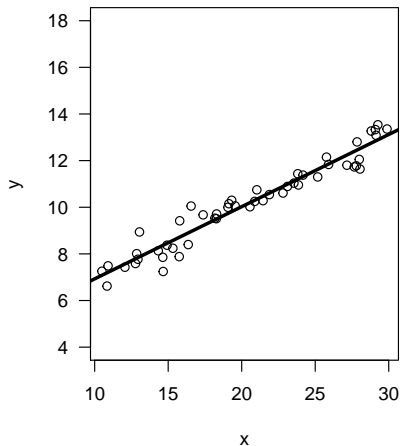
$b$  = slope

$\sigma$  = residual variation

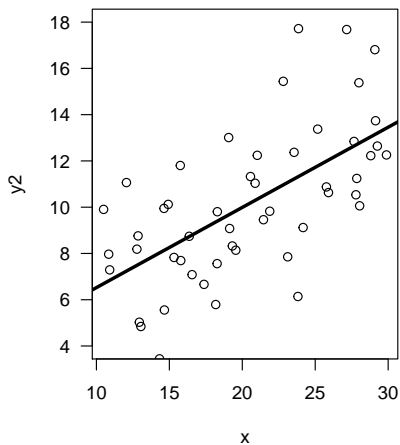
$\varepsilon$  = residuals

# Residual variation (error)

**small**



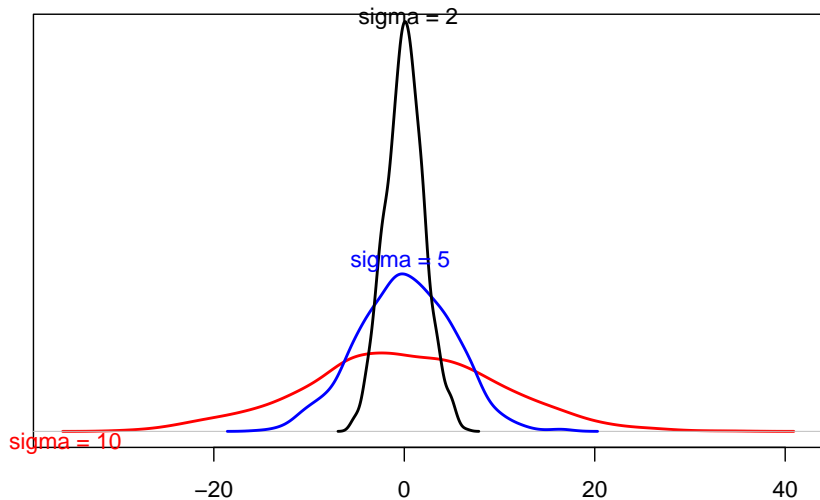
**large**



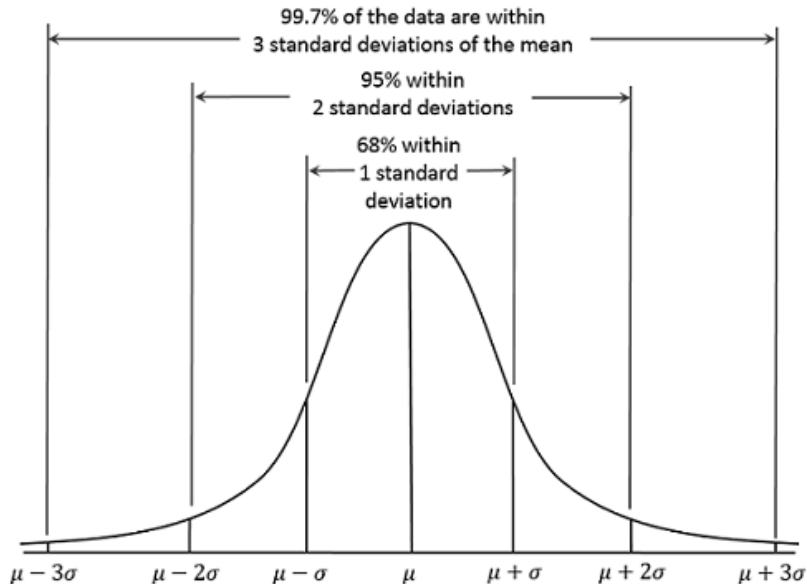
## Residual variation

$$\varepsilon_i \sim N(0, \sigma^2)$$

### Distribution of residuals



## In a Normal distribution



## Different ways to write same model

$$y_i = a + bx_i + \varepsilon_i$$

$$\varepsilon_i \sim N(0, \sigma^2)$$

.

$$y_i \sim N(\mu_i, \sigma^2)$$

$$\mu_i = a + bx_i$$

$$\varepsilon_i \sim N(0, \sigma^2)$$