

Linear regression is flexible!

Some simple transformations

- The linear model we are using consists of making the parameters of probability distributions change according to some function
- The simplest function is a linear function
- Sometimes the relation between parameters and predictors is not linear
- We can use whatever functional shape we like, but it is useful to use transformations to linearize the relation

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

$$\mu_i = \alpha + \beta x_i$$



$$\log(y_i) \sim N(\mu_i, \sigma)$$

$$\mu_i = \alpha + \beta x_i$$

Log transforming the response

Multiplicative increments

- The **logarithmic transformation** of the response is a common transformation when the effect of the predictor on the response is thought to be multiplicative
 - A change of a unit in x is associated with a constant **percentage** change in y
- Many processes benefit from log transformation:
 - Growth is proportional do previous size
 - Any multiplicative process

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

$$\mu_i = \alpha + \beta x_i$$



$$\Delta y \approx \beta \Delta x$$

$$\log(y_i) \sim N(\mu_i, \sigma)$$

$$\mu_i = \alpha + \beta x_i$$



$$\% \Delta y \approx (100 \times \beta) \Delta x$$