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

$$y_i \sim N(\mu_i, \sigma)$$
$$\mu_i = \alpha + \beta x_i$$

$$\longrightarrow$$

$$log(y_i) \sim N(\mu_i, \sigma)$$
$$\mu_i = \alpha + \beta x_i$$

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

$$y_i \sim N(\mu_i, \sigma)$$
$$\mu_i = \alpha + \beta x_i$$
$$\Downarrow$$
$$\Delta y \approx \beta \Delta x$$

$$log(y_i) \sim N(\mu_i, \sigma)$$
$$\mu_i = \alpha + \beta x_i$$
$$\Downarrow$$
$$\% \, \Delta y \approx (100 \times \beta) \Delta x$$

Houle, D., Pélabon, C., Wagner, G. P. & Hansen, T. F. Measurement and meaning in biology. Q. *Rev. Biol*. 86, 3–34 (2011).