Bios 6622 Models for logged data

Rainfall from seeded vs control clouds

Y_i = rainfall (mm)

$Y_i = \mu + \mu_s + \varepsilon_i$, $\varepsilon_i \overset{iid}{\sim} N(0, \sigma^2)$

Seeding assoc with μ_s mm more rain
Additive effect

$\log Y_i = m + m_s + \xi_i$, $\xi_i \overset{iid}{\sim} N(0, \sigma^2)$

$Y_i = e^{m} \cdot e^{m_s} \cdot e^{\xi_i}$

Seeding assoc with e^{m_s} times more rain
Multiplicative effect
Skewed errors

Animal brain and body weights

X_i = body wt
Y_i = brain wt

$\log Y_i = a + b \log X_i + \varepsilon_i$, $\varepsilon_i \overset{iid}{\sim} N(0, \tau^2)$

$Y_i = e^{a} \cdot e^{b \log X_i} \cdot e^{\varepsilon_i} = e^{a} X_i^{b} e^{\varepsilon_i}$

A factor of k change in $X \longrightarrow$ a factor of k^b change in Y.
From R, $\hat{a} = 2.13$, $\hat{b} = 0.75$

E.g. A mammal twice as big ($k = 2$) has a brain

$2^{0.75} = 1.68$ times as big. Brains don't increase as fast as bodys.

Main idea: log scale $\longrightarrow$ Multiplicative effect