

## SLEEP AND GESTATION IN MAMMALS

### RELEVANT JMP PLATFORMS AND STATISTICAL TECHNIQUES

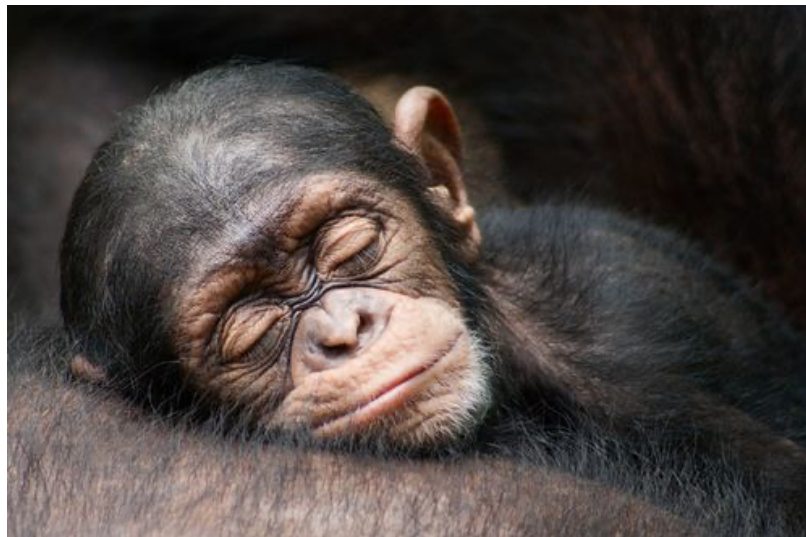
Graph Builder : Scatterplot

Multivariate : Scatterplot Matrix, Correlation

Fit Y by X : Linear Regression, Transformations

### PROBLEM STATEMENT

Sleep patterns of animals, include humans, has been studied quite extensively. Various hypotheses exists on the factors that most impact the amount of sleep, specifically REM (Rapid Eye Movement) and Non-REM sleep an animal experiences.



A scientist from the European Space Agency hypothesized that the length of the gestation period is one of the key factors that determine the amount of REM and Non-REM sleep mammals experience [1].

To explore this hypothesis, data on the average length of gestation, average daily REM and Non-REM for 79 mammalian species was gathered and analyses done to examine the correlation between these variables.

## DATA SET

Sleep\_and\_Gestation\_in\_Mammals.jmp

Mammal	Species name
Gestation	Average gestation time (in Days)
TST	Average total daily sleep time (in hours)
NREM	Average amount of Non-Rapid Eye Movement sleep (in hours)
REM	Average amount of Rapid Eye Movement sleep (in hours)

## EXERCISES

1. Produce univariate graphical and numerical summaries of the four variables.
  - a. Describe the data in a few sentences using these summaries.
  - b. Identify the mammals that have some of the lowest/highest values across these variables.
2. Create a scatterplot matrix showing all possible scatterplots for the four variables along with the correlations.

*Hint: There are six possible scatterplots.*

  - a. Describe the relationships and correlations revealed.
  - b. Which mammals stand out as different from other mammals in a multi-dimensional sense (i.e., have very low or high values in one of the variables relative to its values in another variable)?
3. Build and compare different regression models between Gestation and REM.
  - a. Build a linear regression model between Gestation time and REM.
  - b. Build a linear regression model between  $\log(\text{Gestation})$  time and REM.
  - c. Build a linear regression model between Gestation time and  $\log(\text{REM})$
  - d. Build a linear regression model between  $\log(\text{Gestation})$  time and  $\log(\text{REM})$ .
  - e. Compare the four models. Which model do you think best describes the relationship between Gestation and REM? How much of the variation in REM does your chosen model account (and not account) for?

4. Using the chosen regression model, provide estimates of the following:
  - a. Estimate how much average change there is in REM between Gestation of 30 days to 60 days.
  - b. Estimate how much average change there is in REM between Gestation of 60 days to 90 days.
  - c. Estimate how much average change there is in REM between Gestation of 90 days to 120 days.
  - d. Estimate how much average change there is in REM between Gestation of 120 days to 150 days.
  - e. Why are these estimates of the average change in REM for each 30 day increment in Gestation not the same?
5. Add the following data for human adults and human infants (Adult: 280 days of Gestation, 7 hours TST, 1.6 hours REM, 5.4 NREM ; Infant: 280 days Gestation, 15.5 hours TST, 7.75 REM, 7.75 NREM).
  - a. Recreate the scatterplot matrix. How do the values for human adult and human infant compare to the rest of the mammals?
  - b. Update your chosen model from Exercise 3 to include these two new data values. Does this model do well at predicting the REM of a human adult and/or a human infant? Describe this numerically.
6. Are there any other potential reasons you can think of that might influence how much REM sleep a mammal experiences? In other words, what additional data would be helpful to have in order to explore if REM could potentially be better predicted?

## SUPPLEMENTAL MATERIALS

1. Gonfalone, Alain A. "Negative correlations between gestation and sleep duration of mammals" *Animal Physiology*, 2016.  
<https://www.dovepress.com/negative-correlation-between-gestation-and-sleep-durations-in-mammals-peer-reviewed-fulltext-article-OAAP>

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