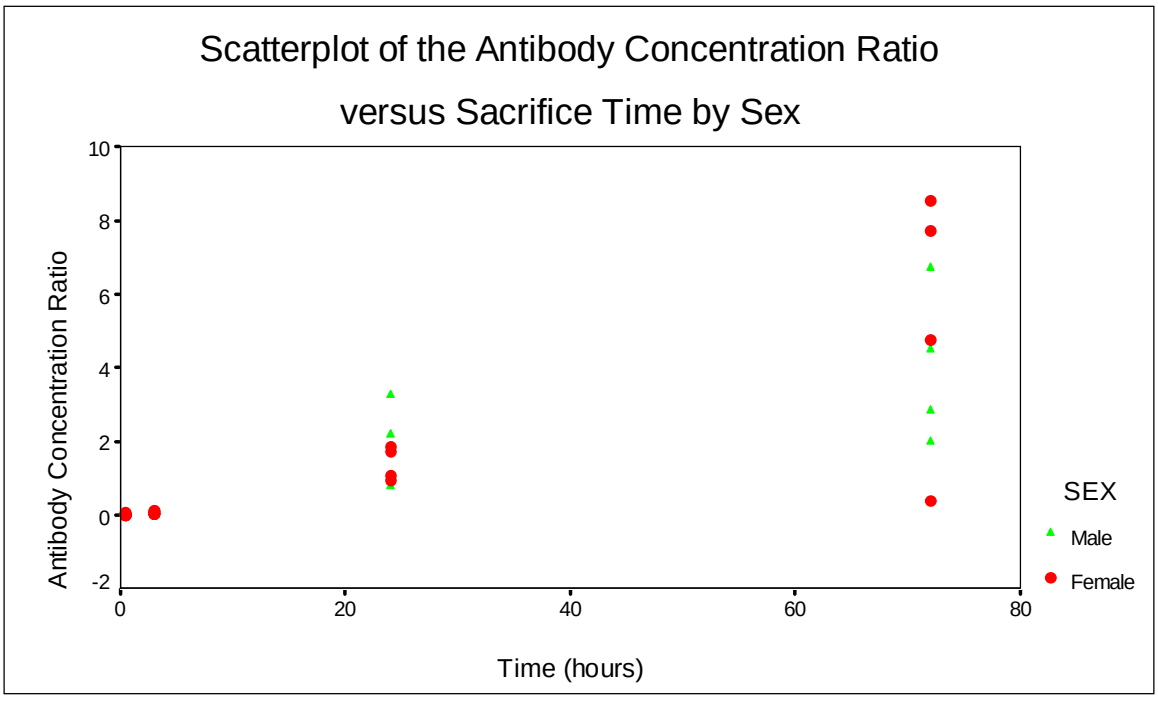
BLOOD-BRAIN BARRIER EXPERIMENT

4. Displaying the Relationships between Variables

The graphical displays of the data allow us to better understand the information contained in the data. In this section we will visualize the data by obtaining the scatterplots of the ratio of antibody concentration in brain tumor to antibody concentration in liver versus sacrifice time by type of treatment or sex.

4.1 Scatterplot of the concentration ratio versus sacrifice time by sex
4.2 Scatterplot of the concentration ratio versus sacrifice time by the type of treatment
4.3 Scatterplot of the log concentration ratio versus sacrifice time by the type of treatment
4.4 Log-Log Scatterplot of the concentration ratio versus sacrifice time by the type of treatment
4.5 Scatterplot Matrix

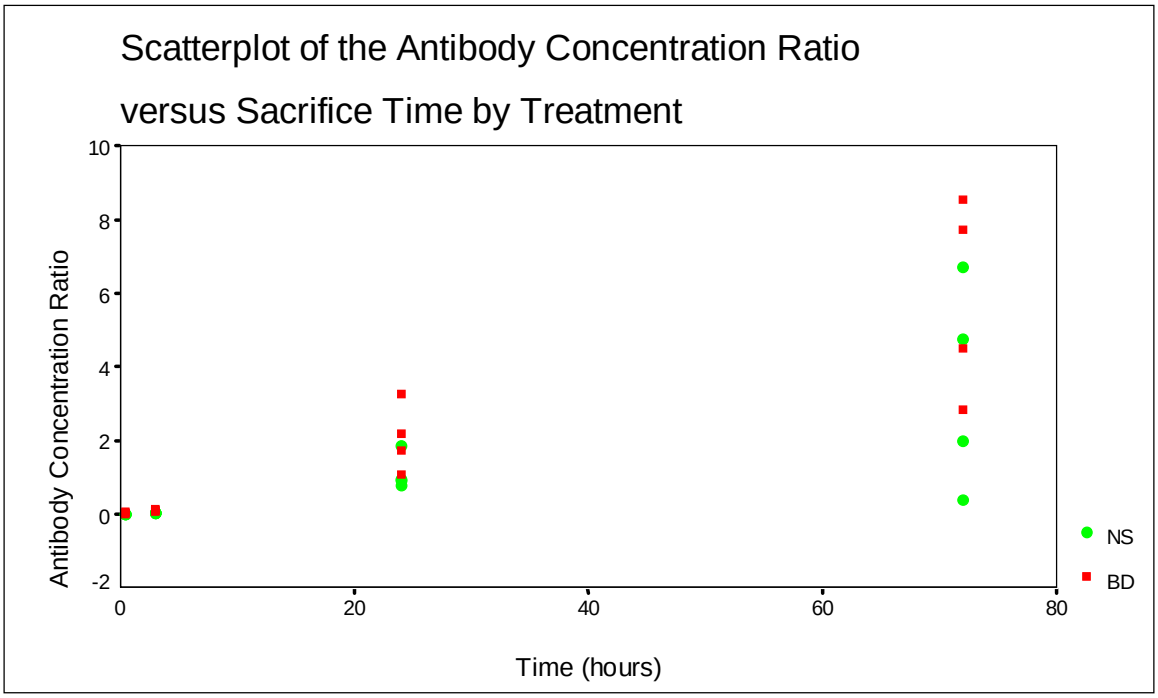
4.1 SPSS produces the following scatterplot of the concentration ratio versus sacrifice time by sex:



The above scatterplot does not provide any evidence of the difference between the antibody concentration ratio for male and female rats. The plot does not provide any evidence that the response is somehow related to the sex of the rat. Notice that if the response is suspected to be related to the sex of the rat, a randomized block experiment should be performed.

The plot indicates that there is a larger variability in the antibody concentration ratio as the sacrifice time increases.

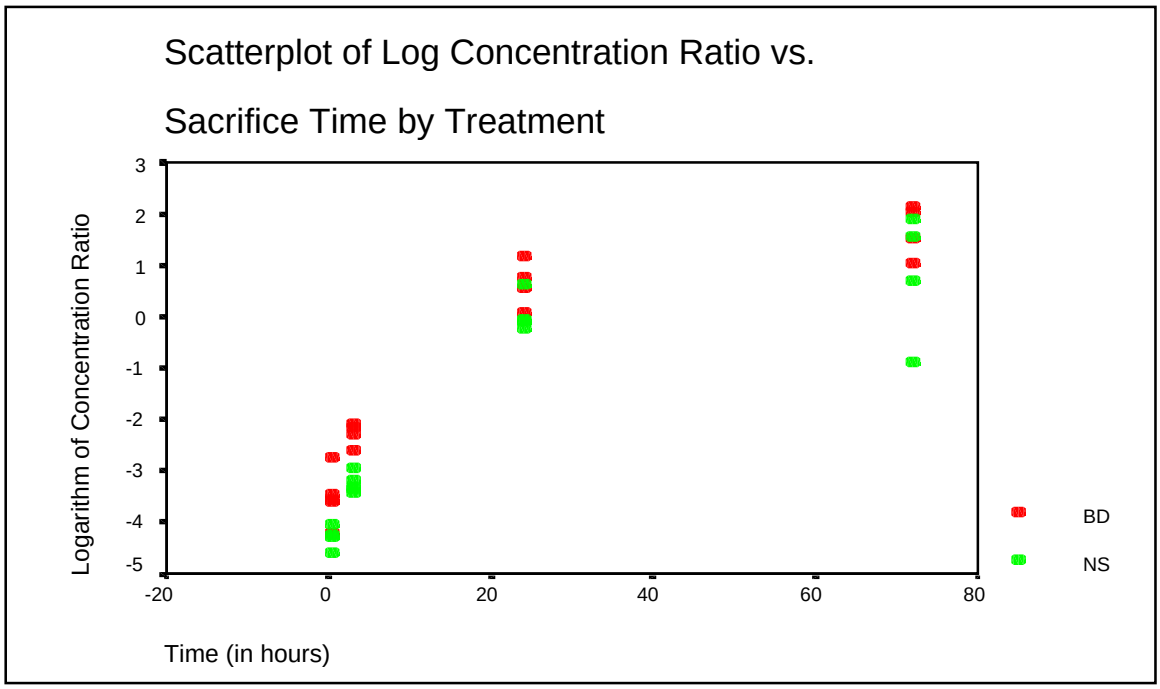
4.2 The scatterplot of the antibody concentration ratio versus sacrifice time by treatment (BD, NS) is displayed below:



There is a weak positive linear relationship between antibody concentration ratio and sacrifice time. The antibody concentration ratio increases with the length of time after the infusion. The observations obtained for the BD treatment for each sacrifice time level are usually above the corresponding observations for the control treatment. Apparently, the disruption solution does allow more antibody to reach the brain than the control solution does.

The plot indicates that there is a larger variability in the antibody concentration ratio as the sacrifice time increases. The large spread suggests the need for a log transformation.

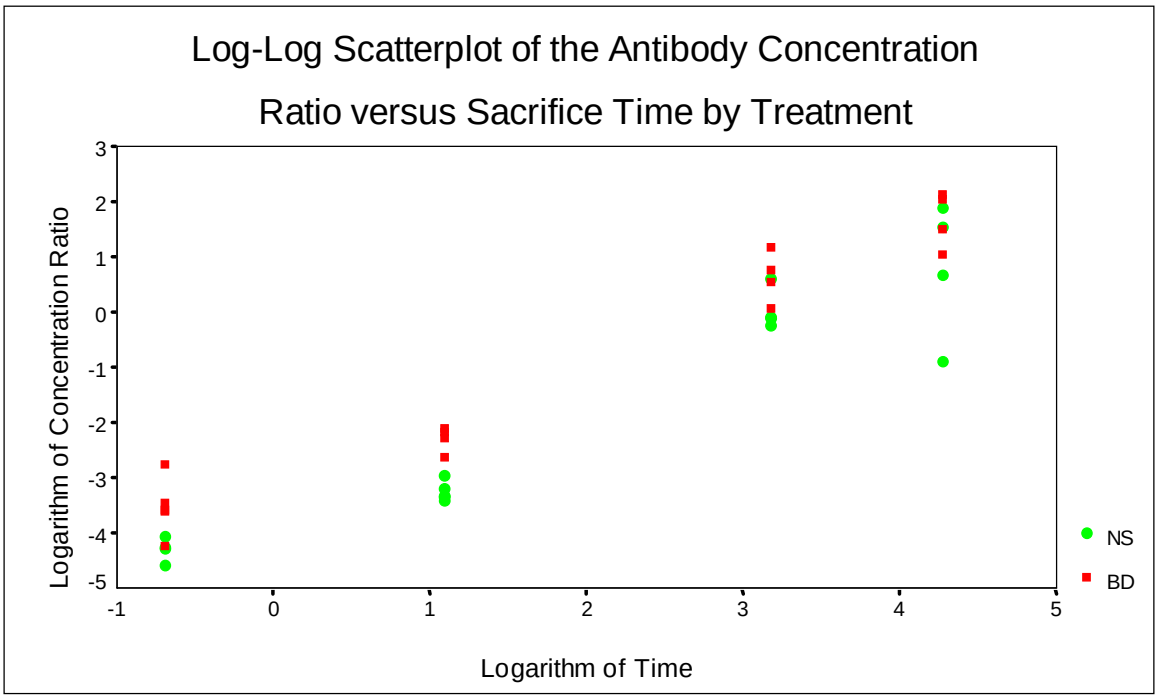
4.3 The scatterplot for the log-transformed concentration ratio and sacrifice time is shown below:



The log transformation helped to compress the data, but it did not make the relationship between the log-transformed ratios and sacrifice time more linear. The curved pattern displayed in the plot indicates a non-linear relationship between antibody concentration ratio and sacrifice time. The log antibody concentration ratio increases with the length of time after the infusion.

The observations obtained for the BD treatment for each sacrifice time level are usually above the corresponding observations for the control treatment. Thus, the disruption solution does allow more antibody to reach the brain than the control solution does.

4.4 The scatterplot for the log-transformed concentration ratio and log-transformed sacrifice time is shown below:

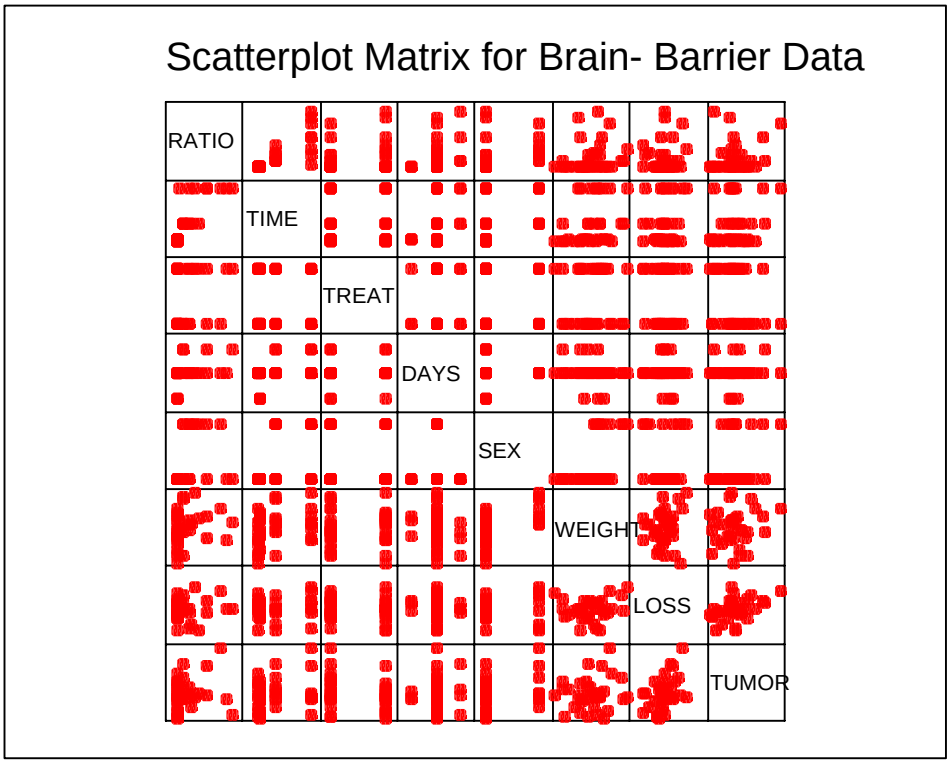


There is a stronger linear pattern in the plot than that one exhibited in Section 4.2. However, a slight curvature is displayed, and therefore a straight-line regression model may be not adequate to describe the relationship between the logarithm of the concentration ratio and the logarithm of sacrifice time.

The visual inspection of the plot confirms the conclusions we have reached in Section 4.2. In particular, the plot indicates that the barrier disruption (BD) solution does allow more antibody to reach the brain than the control solution does. The effect is about the same across the four levels of sacrifice time; an increasing proportion of antibody reaches the brain with increasing time after infusion.

Moreover, the plot suggests that the difference between the two treatments seems to be greater for the shorter sacrifice times than for the longer ones. In other words, the plot may indicate an interaction between sacrifice time and treatment.

4.5 SPSS produces the following scatterplot matrix:



The matrix shows a strong relationship between the response (RATIO) and sacrifice time (TIME). Moreover, the type of treatment clearly affects the response. The matrix indicates that the covariates-days after inoculation, initial weight, and sex of the rat are also associated with the response. These covariates are also related to the treatment given. In particular, rats treated at longer days after inoculation were also assigned to the longer sacrifice times. Furthermore, all male rats were assigned to the longer sacrifice times.