ASSIGNMENT 19

Ophthalmology

The disease *retinitis pigmentosa* refers to a group of hereditary, retinal pigmentary degenerations in which patients report night blindness and loss of visual field, usually between the ages of 10 and 40 years. Some patients lose all useful vision (i.e., become legally blind) by the age of 30 years, while others retain central vision even beyond the age of 60 years. A specific gene has been linked with some types of RP where the mode of genetic transmission is autosomal dominant. The most reliable methods of following the course of RP in humans is by using the electroretinogram (ERG), which is a measure of the electrical activity in the retina. As the disease progresses, the patient's ERG amplitude declines. The ERG amplitude has been strongly related to the patient's ability to perform routine activities, such as driving or walking unaided, especially at night.

One hypothesis is that direct exposure of the retina to sunlight is harmful to RP patients, so many patients wear sunglasses. To test the sunlight hypothesis, a group of mice had this gene introduced and were mated over many generations to produce a group of "RP mice." The mice were then randomly assigned to lighting conditions from birth that were either (1) light, (2) dim, or (3) dark. A control group of normal mice were also randomized to similar lighting conditions. The mice had their ERG amplitudes (labeled BAMP and AAMP for B-wave amplitude and A-wave amplitude), which correspond to different frequencies of light, measured at 15, 20, and 35 days of life. In addition, the same protocol was used for a group of normal mice except that only B-wave amplitude was measured. The data for both RP mice and normal mice are available in the Data Set MICE.DAT and the documentation in MICE.DOC (both on the data disk).

The data have the following form:

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1-2         ID
4           GROUP 1=RP  2=NORMAL
6           TREATMENT GROUP
              A=LIGHT
              B=DIM
              C=DARK
8-9         AGE
11-14       B AMP
16-19       A AMP
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Analyze the data regarding the sunlight hypothesis using a model in BUGS. Consider the A-wave amplitude to fit a model with different slope for each treatment group. Consider various transformations and distributions and decide on which model is appropriate using Bayesian arguments.