Blood Gas and Acid-Base Balance Experiments
BI-374, Dr. C. S. Tritt
Plots due: 3/21/06

Work in groups of two or three. Each group should submit one set of plots for this exercise. You may allocate the work in your group any way you wish, but everyone should understand what was done. Produce plots illustrating the following effects and relationships:

- The effect of P_{CO2} or pH on the oxygen partial pressure-content relationship (the Bohr effect).
- The effect of hemoglobin saturation on the carbon dioxide partial pressure-content relationship (the Haldane effect).
- The relationship among bicarbonate concentration, carbon dioxide partial pressure and pH (attempt to reproduce the pH-bicarbonate diagram). This plot should consist of at least six curves on one set of axis.

Plots should be of engineering quality (have consistent number of significant digits in axis labels, have both vertical and horizontal grids, be labeled with the creators initials and the date created, etc.). Plan your work before you start collecting data for best results.

The BLOOD Program

I wrote the Blood program while working on my Masters degree. It is starting to show its age (i.e. it's a DOS program written in Pascal), but still provides very good data for the investigation of blood gas behavior and acid-base balance. The program (and its associated data files) is available for download from http://www.msoe.edu/~tritt/blood.html. It is probably best to download the zip file to your local hard drive. Then run WinZIP or PowerArchiver from NAL to extract the files to their own folder. Finally, use Start | Run to execute *blood.com*.

The program will ask you a series of questions regarding how to model blood gas and acid-base behavior. I recommend you enter *Human* for the Lutz file name (other valid file names include pig, mouse, etc. and indicate the species to be modeled). I recommend you use *Kelman's* CO_2 content method. Select *Independent pH entry* to have the program calculate base excess or decline *Independent pH entry* in which case you'll enter the base excess of the blood and the program will calculate its pH. Select output to the screen and initially accept all the default parameter values (record them in your lab notebook), then proceed with your experiments. During data entry, blank entries result in previous values being retained.

Generating the pH-bicarbonate diagrams can be a little tricky. Getting the isobars is relatively easy; you just select independent pH entry and enter a series of pH values and record bicarbonate concentrations for each P_{CO2}. Generating the lines of constant base excess is a little harder. For these lines, decline independent pH entry (this results in the program asking for base excess values). For each Base Excess value of interest, enter a series of P_{CO2}'s and record the generated pH and bicarbonate concentration values for plotting.