Science Objectives

- Students will calculate the volume of blood in their own bodies.
- Students will analyze and quantify some of the components of their blood.

Math Objectives

- Students will use tabular data to accurately generate a scatter plot.
- Students will generate a linear regression model, use the function to perform calculations, and interpolate a value on the regression model.

Materials Needed

- TI-Nspire™ or TI-Nspire™ CAS unit for each student
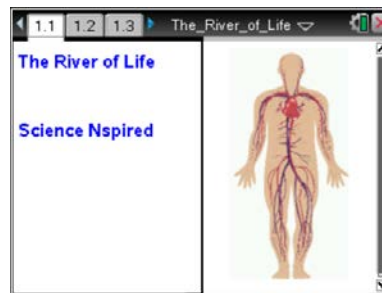
Vocabulary

- plasma
- erythrocytes
- leukocytes
- milligram
- microliter

About the Lesson

- This lesson involves generating a linear regression model for human blood volume vs. body weight.
- As a result, students will:
    - Algebraically calculate their own blood volume.
    - Interpolate on the regression model to determine their blood volume.

TI-Nspire™ Navigator™ System

- Screen Capture to monitor student progress.
- Live presenter allows students to show their graphs to the class.

TI-Nspire™ Technology Skills:
- Download a TI-Nspire™ document
- Open a document
- Move between pages
- Entering and graphing data using multiple applications
- Tracing, interpolating, predicting

Tech Tips:
- Make sure the font size on your TI-Nspire handhelds is set to Medium.
- You can hide the function entry line by pressing (ctrl) [G].

Lesson Materials:
Student Activity
- The_River_of_Life.pdf
- The_River_of_Life.doc

TI-Nspire document
- The_River_of_Life.tns

Discussion Points and Possible Answers

Create a new TI-Nspire™ document.

1. Add a *Lists & Spreadsheets* page.
2. Name Column A **weight**, and Column B **pints**.
3. In cell A1, enter the number **60**, then continue to enter values in this column—adding 24 to the previous number—until you reach 300.
4. In cell B1, enter the number 5, and increase it by 2 in each succeeding cell until you have reached 25.
   - The weights are in pounds, and the pints are the number of pints of blood in the human body.
   - Double-check to make sure you have the same number of items in each column.
5. According to the data table, what is the relationship between body weight and blood volume?

   Answer: As body weight increases, blood volume increases.

6. a. What is the change in weight from data point to data point?

   Answer: 24 pounds

   b. Is the ΔX the same between each two consecutive *x*-values?

   Answer: Yes

7. a. What is the change in blood volume from data point to data point?

   Answer: 2 pints

   b. Is the ΔY the same between each two consecutive *y*-values?

   Answer: Yes

8. Now, graph the data by inserting a *Data & Statistics* page.
9. Select **weight** as the *x*-value and **pint** as the *y*-value.
10. Use this graph to figure out approximately how much blood YOU have in your body.
    - There is more than one way to do this, so play around until you find a method that works for you.
    - Hint: It might be a good idea to have a "best-fit" line on your graph.
11. Next, insert a *Graphs* page, graph your data again, and figure out a way to determine your blood volume using this page.

After you have finished experimenting with weight and blood volume, move on to the questions that accompany this activity.

12. What is the significance of your answers to #10 and #11?

    Answer: It means the graph will be linear.

13. What is the formula for determining the volume of blood if you know your weight?

    Answer: Pints = 0.083*weight (y=0.083x)

14. a. Using the regression model (best-fit line) you produced, estimate the volume of blood you have in your body.

    Answer: Answers will vary.

    b. How did you make your estimation?

    Answer: Several methods: putting their weight into the equation and solving for pints; tracing along the regression line; etc.

15. How much blood would there be in a person who had a mass of 75 kg? Hint: there are about 2.2 pounds in one kilogram.

    Answer: 15.6 pints

16. Estimate the weight in pounds of a person who has 11.5 pints of blood in his body.

    Answer: 139 pounds

17. How much blood would a 7-pound newborn baby have?

    Answer: 0.6 pints

18. If this weight/blood volume relationship were true for other animals, too, how many gallons of blood would there be in a horse that had a mass of 500 kg?

    Answer: 11.4 gallons

19. Estimate the weight of a person who has two gallons of blood in his body.

    Answer: 193 pounds

20. If you decided to donate blood at the blood bank, you would donate one pint. Using your own weight, calculate the percentage of your blood you would be donating.

    Answer*:* Answers will vary. Lower percentage for heavier people*.*

21 a. If 52% of your blood is water, what is the volume of water circulating in your blood vessels right now?

    Answer*:* Answers will vary*.*

    b. Which of the two main blood components contains the water?

    Answer*:* Plasma

22. Sodium is an abundant ion in the bloodstream. Normally, there are about 2400 milligrams of sodium in one liter of blood. If one liter of blood is about the same volume as two pints of blood, approximately how much sodium do you have flowing through your blood vessels right now? Express your answer in both milligrams and grams.

    Sample Answers: Answers will vary.

23. One of the most important functions of the blood is to transport oxygen to all of your cells, and the cells that take care of this for you are called erythrocytes, or red blood cells. Red blood cells are by far the most numerous cells in the blood, averaging about 4.5×10^6 cells per microliter (1000 microliter = 1ml; 1000ml = 1L). How many microliters are there in one liter? Using this information, calculate the approximate number of red blood cells you have in your body right now.

   <u>**Sample Answers**</u>: Answers will vary

24. Leukocytes, or white blood cells, are another type of blood cell in your body. Human blood contains about 7.0×10^3 WBC's per microliter. Calculate the approximate number of leukocytes you have in your body right now.

   <u>**Sample Answers**</u>: Answers will vary.

25. White blood cells function mainly in defending you against infections. Explain why the number of white blood cells in a person's body may tend to fluctuate a lot more than the number of red blood cells does.

   <u>**Answer**</u>*:* WBC numbers tend to increase when a person is sick or injured*.*

TI-Nspire Navigator Opportunity: *Screen Capture*
See Note 1 at the end of the lesson.

Wrap Up

Assessment

Formative assessment will consist of questions embedded in the TI-Nspire document. The questions will be graded when the document is retrieved. The Slide Show can be utilized to give students immediate feedback on their assessment.

TI-Nspire™ Navigator™ Notes

Note 1: Screen Capture

Screen Capture can be used to monitor student progress.