

MODULE 4: Blood

This lab will include some activities and require some research that will help you understand and appreciate the structure and function of blood. There will be an online worksheet that you will enter your answers on. You will be allowed to "Save for Later" and "Submit" the worksheet as many times as you want. However, there are a couple of things to keep in mind.

1. You will not be allowed to Submit your worksheet after the deadline. If you do not submit before the deadline, you may be able to work out a way to submit it as a late assignment but there will be point deductions.
2. If you Submit the lab assignment, and then decide to retake it before the deadline, all of your answers will be gone and you will have to retype all answers before submitting again.

The lab worksheet has been reproduced for you on the following pages, so that you can work on things offline. If you have printed the lab manual, you might write notes in the textbox fields, or you might use a .pdf document annotator on your computing device. Whatever you decide to do is fine, but ultimately, only answers entered on the I-learn worksheet can be submitted for grading.



Follow the instructions below very carefully. Many of the items in this assignment require reading or videos or something else to do. Be sure to write your answers completely before submitting the assignment. There is an option in the bottom right to save your answers and come back later, but once you submit this assignment, it will be graded.

Blood

Since the beginning of time, people of all ages have considered blood to be the “essence of life.” What is blood and why is it so important for our bodies in carrying out the essential processes of life? Blood is a type of connective tissue consisting of a liquid matrix that plays an essential role in the transportation process of the cardiovascular system. The liquid matrix or plasma, which consists of 90% water and 10% solutes (albumin, globulins, and fibrinogen; and minerals) makes up about 55% of the total blood volume, and the formed elements, which includes: the Erythrocytes (red blood cells), the Leukocytes (white blood cells) and the platelets, make up the other 45%. The total blood volume in humans ranges from about 4-5 L in females to 5-6 L in males.

[CLICK HERE](#) to watch a video that instructs you on how to tell the difference between blood cells.

1. Which of the following is a circulating blood cell that is capable of differentiating into a cell that synthesizes antibodies?

- Neutrophil
- Basophil
- Lymphocyte
- Monocyte

2. An increased neutrophil count is typically associated with:

- An ongoing bacterial Neutrophil
- Neutropenia
- Allergic reactions
- An ongoing parasitic infection

3. Which of the following blood cells have some properties similar to Mast Cells?

- Basophils
- Neutrophils
- Eosinophils
- Lymphocytes
- Monocytes

4. _____ eventually become macrophages.

- Neutrophils
- Basophils
- Monocytes
- Erythrocytes
- Lymphocytes

5. Match the following descriptions with the correct blood cell.

1. Often called a Leukocyte.	a. None of the answers are correct
2. Least numerous of the circulating leukocytes.	b. Monocyte
3. First line of cellular defense against a bacterial invasion.	c. Neutrophils
4. Most numerous of the circulating leukocytes.	d. Basophils
5. Has Specific granules that contain heparin and histamine.	e. All Answers are correct
6. Often Bi-lobed, granules often stain red or orange. May release chemicals that fight inflammation.	f. Lymphocyte
7. Round nucleus, thin ring of cytoplasm around the edge. This cell also contributes to graft rejections.	g. Eosinophil
8. Phagocytic cell. Leaves the blood to become a Macrophage in the tissues	
9. Carries a "Heme" group and is important for oxygen transport.	

Blood Typing

Every person's blood belongs to one of four ABO blood groups (type A, Type B, Type AB, and Type O) and in addition, blood is either Rh positive or Rh negative. The factors in the blood which determine blood type are proteins located on the outer surface of the red cells. These proteins are called agglutinogens or antigens. Red cells of type A blood have type A antigens (agglutinogens). Red cells of type AB blood have both A and B antigens (agglutinogens). Red cells of type O blood have neither A or B antigens.

People who have type A blood have antibodies dissolved in their plasma which bind tightly to B antigens on red cells. These red cell binding antibodies are called B antibodies. Type B blood has in its plasma the A antibodies. Type AB blood has neither A nor B antibodies. Now consider what would happen if type A cells were mixed with serum from type B blood. The A antibodies present in the serum would bind tightly to A antigens on the red blood cells. This results in clumping of red blood cells.

To determine blood type, a small drop of blood is mixed with anti-A antiserum. Clumping of red cells will occur if the blood is type A or type AB, but not if the blood is type B or type O. Then a drop of blood is mixed with anti-B antiserum. Clumping will occur if the blood is type B or type AB, but not if the blood is type A or O.

In RH positive blood, red cells may contain antigens of the Rh group. The most common of these is designated "D". The antiserum used to detect this Rh antigen is termed anti-D antiserum. If the D antigen exists we often refer to that as "+" or we use the term "positive". Clumping or agglutination of red cells when placed in anti-D antiserum indicated the Rh positive blood type. If no clumping occurs in this antiserum, the blood is Rh negative.

In the case of a transfusion, a person's blood type needs to be compatible with the donor's blood type or a reaction can occur resulting from the immune system antibodies of the recipient attacking the incompatible donor blood cells. Also, it is very important to know the Rh factor status when a woman is pregnant. If a pregnant woman is Rh negative and her baby is Rh positive, the mother's immune system can sometimes attack the baby's blood cells because the mother will generate Rh antibodies and the baby will have Rh antigens. All women should have a blood typing test done to see if they are at risk. This blood typing is generally be done as part of routine prenatal care.

[CLICK HERE](#) to watch a video that shows how we do a blood typing test in our lab. Students attending campus are instructed on how to do this for themselves.

[CLICK HERE](#) to access an online tutorial that teaches and allows for self quizzing across all the possible blood type reactions.

CLICK HERE to access an online "Blood Typing Game" that is good for your practice to be sure you can answer blood typing questions on the exam.

6. Did you complete all of the "Click Here" activities above?

- Yes
- No

7. What are the 4 main blood types (Without considering the Rh antigen group)?

8. What are all the blood types that are ok for a person with B+ blood to receive?

9. If a person has type A- blood, then he or she would have what antibodies in their own serum?

10. What type of blood is considered the universal donor. Explain why this type of blood works as a universal donor.

11. If a person has O+ blood, then list all the types of blood that they CANNOT receive.

Hematocrit

The hematocrit is the portion of total blood volume that is occupied by packed, (centrifuged) red blood cells. The hematocrit is expressed as a percentage by volume. For example, a hematocrit of 25% means that there are 25 milliliters of red blood cells in 100 milliliters of blood. In this same example, the red cells would make up a quarter of the blood. This person would be in trouble because the normal ranges for hematocrit are generally closer to 40% or 50%. Hematocrit does depend to some degree on a person's fitness level, age, and gender. The normal ranges for hematocrit are:

- Newborns: 55-68%
- One (1) week of age: 47-65%
- One (1) month of age: 37-49%
- Three (3) months of age: 30-36%
- One (1) year of age: 29-41%
- Ten (10) years of age: 36-40%
- Adult males: 42-54%
- Adult women: 38-46%

Hematocrit is determined by collecting a small amount of blood in a capillary tube. This blood is then centrifuged at a high speed to pack the red cells. With all the cells packed at the bottom of the tube, you can calculate what percentage of the total volume that is red blood cells.

[CLICK HERE](#) to watch a video that shows how we do a hematocrit test in lab.

HEMATOCRIT CASE STUDY:

Every 4 years the best athletes from around the world put their training and abilities to the test at the Winter Olympic games. For some, athletes have frequently tried to improve their abilities through artificial means, often called ergogenic aides. Consider the true story of Johann Muehlegg. Muehlegg was a German born skier who competed in the Olympic games for both Germany and later Spain after moving there in 1999. He was most famous for winning several gold medals at the 2002 Winter Olympic games in Salt Lake City but then later being accused of blood doping and having his medals taken away from him. He was charged with using performance enhancing drugs that would enhance the oxygen carrying capacity of his blood. Below are some tables. The first shows normal ranges and the next two show a data set similar to data collected from Muehlegg

earlier in the year before the olympics. The final data set shows data similar to what was collected at the 2002 Olympics while Muehlegg was competing.

	Normal Ranges	
	Male	Female
Hematocrit	40-50%	37-47%
Hemoglobin(g Hb/dL*blood)	14-17	16-Dec
Red Cell Count(cells/ μ L)	$4.5-6.5 \times 10^6$	$3.9-5.6 \times 10^6$

Possible Data sets for Muehleggs test results:

	Data set 1
Hematocrit	50%
Hemoglobin(g Hb/dL*blood)	17
Red Cell Count(cells/ μ L)	5.5×10^6

	Data set 2
Hematocrit	53%
Hemoglobin(g Hb/dL*blood)	17.5
Red Cell Count(cells/ μ L)	6.3×10^6

When confronted about how the data had changed (see tables above), Muehlegg claimed that it was due to his special diet and the dehydration he had experienced due to diarrhea that he had suffered the night before.

12. Explain how diarrhea could cause a hematocrit value to increase.

13. What is a way that you can think of that Muehlegg might Quickly decrease his hematocrit? Explain.

14. Muehlegg was eventually charged with using "Darbepoeitn". Do your own research and explain how this drug affected Muehlegg's physiology and how it might have helped him perform better.

15. Bill decides to donate blood for a recent Red Cross drive. A blood test several days later revealed that Bill had a higher than average reticulocyte count. Do your own research on a reticulocyte count and answer the following. What are reticulocytes and explain how donating blood could increase their numbers.

Blood Lipid Profile

Blood Lipid Profiles involve a test that can help us determine the risk for coronary heart disease. Blood lipid profiles measure and individuals total cholesterol, high density lipoproteins (HDL), low density lipoproteins (LDL), and triglyceride levels (among other things) in the blood. This test is usually performed after a period of fasting for 12 hours so as not to invalidate the results because of a previously eaten meal.

CLICK HERE to see a video of how a blood lipid profile is done in lab. If you are doing this lab on campus, your instructor will explain how you can do your own lipid profile in lab. If you are doing this lab strictly online, your instructor may give you extra credit to find a place that will help you do your own lipid profile. Check with your instructor.

Do your own research to find out if your values are within normal ranges. This information is easy to find online and you may also find a lot of advice on how to improve your numbers. Be careful though, not all advice given on the internet is validated by good scientific research.

16. What concerns if any should the following individual have?

- LDL 170, TC 200, HDL 41, Tri-Gly 155?

Students are very interested in their health and they want to live forever. Many have asked over the years if increased exercise can improve lipid profile numbers.

[CLICK HERE](#) to access an article that reviews what we think we know about the influence of exercise on lipid profiles.

17. Write an essay and summarize what you learned about exercise and lipid profiles. Be sure to summarize what the authors point out about the intensity of exercise.