Lab 15
Blood, Lymphatics, & Immunity

Laboratory Objectives

- List and describe the formed elements of the blood.
- Describe the maturation of the formed elements from pluripotent stem cells to the mature blood components.
- Define hematocrit. Given centrifuged capillary tubes, calculated the hematocrit for a blood sample.
- List and describe the three main functions of the lymphatic system.
- Describe the production and flow of fluid through the lymphatic system.
- Distinguish nonspecific vs. specific resistance to disease, and describe the major mechanisms of each response.
- Distinguish the developmental origin of T cells and B cells.
- Describe the immunological basis of the HIV virus.
Activity 1: Formed Elements of the Blood

1. All of the formed elements in the blood come from the “myeloid stem cell” except what group of cells?

2. How is a reticulocyte different from a mature red blood cell? Why would a physician be interested in a patient’s reticulocyte count?

3. What is the difference between a monocyte and a macrophage?

4. The amount of formed elements in the blood are given as the number of cells found in a cubic micrometer (1 mm$^3$ = 1 µL) of whole blood. Match RBCs, platelets, and WBCs: to these three categories:
   - Found in the millions
   - Found in the hundreds of thousands
   - Found in the thousands, per uL of blood.

Activity 2: Hematocrit

1. Using a millimeter ruler: What is the length of the whole column (packed RBCs, WBCs, and plasma for both capillary tubes?)

2. Using a millimeter ruler: What is the length of the packed red blood cell section for both capillary tubes?

3. What is the percentage of red blood cells in both capillary tubes? Hint: Divide the length of the packed red cells by the length of the whole column, and multiply the result by 100.

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\frac{\text{Length of RBCs in mm}}{\text{Length of the whole column}} \times 100 = \text{Hct (%)}
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Activity 4: Hemoglobin

Before proceeding to the case study, answer the following questions.

Why is a biconcave disk an ideal shape for red blood cells?

Why does a red blood cell need to demonstrate “reversible-deformity”?


1. How does the replacement of an amino acid with a polar side-chain (glutamic acid) with another having a non-polar side-chain (valine) cause a change in a protein’s structure?

2. It is very common for a patient with this disorder to have an enlarged spleen. Why?

3. The case study never really states why Joe has yellow eyes. Why would this be the case?
Activity 5: The Lymphatic System

1. What are the three main functions of the lymphatic system?

2. What is the difference between lymphatic fluid and blood plasma?

3. Why might a bacterium or cancer cell have an easier time accessing a lymphatic vessel than a blood vessel?
Activity 6: Lymph Circulation

What is the highlighted lymphatic organ, and what type of fluid passes through the highlighted vessels? Describe the fluid to blood plasma.

Which lymphatic duct receives fluid from the highlighted areas?

1. 

2. 

3. 

4.
Activity 6: Lymph Circulation

Which lymphatic duct receives fluid from the highlighted organ?

Which vein receives lymphatic fluid from the highlighted duct?

Identify the highlighted organ and its role in the lymphatic system.
Activity 7: Specific and Non-Specific Disease Resistance


1. Contrast specific and non-specific disease resistance as they relate to:

   Availability at birth?

   Activation time?

   Components?

   Protection specificity?
1. How does interferon contribute to disease resistance?

2. Isn’t fever a bad thing? How is fever beneficial?

3. What are the two roles of complement proteins?
Activity 9: Microbe Massacre

A series of animations depicting disease resistance mechanisms will randomly play. Following each animation, you will have 15 seconds to click on the appropriate mechanism from the list at the right. Click on the Play button when you are ready to begin.


1. Do antibodies physically destroy antigens?

2. What does it mean to “enhance” phagocytosis?

3. What does it mean when a cell participates in cytolysis?

4. Why is fever a normal beneficial mechanism of disease resistance?
1. Why are T-helper, macrophages, and follicular dendritic cells the target of the HIV virus?

2. Why is the T-helper cell referred to as the master cell of the immune response?

3. What is an opportunistic infection?