

Supplemental Material

CBE—Life Sciences Education

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Appendix A

Sample Problems for Internal Transport, Immunity, and Gas Exchange

Activity 1. Identifying types of blood vessels

For each statement below, identify whether it describes **Arteries**, **Arterioles**, **Capillaries**, or **Veins**.

- _____ Carry blood away from the heart
- _____ Are located in very close proximity to most cells of the body
- _____ Carry deoxygenated blood
- _____ Return blood to the heart
- _____ Walls are one cell thick
- _____ Walls consist of three layers
- _____ Help regulate blood pressure

Activity 2. Diagram of Human Heart

Pair up with a partner, and do a rough sketch of the human heart. Be sure to include as many chambers, valves, and major arteries/veins involved in blood circulation as you can. Do NOT label your diagram, but provide a list of words for another group to label the diagram. Upon completion of your sketch, your peer leader will assign you another groups' sketch to label. After labeling the diagram assigned to your group, refer to the textbook and draw in any missing parts of the heart.

After completion of all parts of the human heart diagram, number the steps of blood flow through the heart beginning with the superior vena cava and ending with the aorta.

Activity 3. Internal Transport Discussion Questions

1. What is the significance of the thickness of the capillary wall?
2. How is the pulmonary artery different than all other arteries of the body?
3. Compare the mammalian heart to the fish, amphibian, reptilian, and bird heart.

- a. How many atria does each heart have?
- b. How many ventricles does each heart have?
- c. Does blood flow through a single circuit or double circuit?
4. What is the advantage of having a circulatory system that separates oxygen-rich and oxygen-poor blood?

Activity 4. Sequential order

Place the following lists in the correct sequential order.

1. **Airflow:** nostril, bronchus, alveoli, bronchiole, pharynx, larynx, trachea
2. **Pulmonary circulation:** right ventricle, pulmonary vein, left atrium, right atrium, pulmonary artery
3. **Blood clotting:** fibrinogen, thrombin, prothrombin, fibrin
4. **Antibody-Mediated immunity:** B cell activated, pathogen is destroyed, B cell cloned, pathogen invades body, B cells differentiate into plasma cells, activated T cell interacts with B cell to display antigen, antibodies produced
5. **Cell-Mediated Immunity:** T cytotoxic cell activated by foreign antigen-MHC complex, T helper cells activated by foreign antigen-MHC complex presented by APC, T cytotoxic cells form clones and go to site of infection, activated T helper cell gives rise to a clone of T helper cells and memory cells, T cytotoxic cells destroy target cells, virus invades body
6. **Systemic circulation:** vena cava, right atrium, left atrium, aorta, arteries, capillaries, left ventricle, veins

Activity 5. Immunity Flowcharts

A flow chart can be used to illustrate a sequence of steps in a process. For example, to complete PLTL Workshop activities:

Leaders split students into groups → Students work on problems → Groups explain their solutions to others in the larger group

1. Using your own words, describe how HIV infects an individual. Begin with exposure to the virus.
2. Using your own words, describe the steps that may occur if an individual's body rejects transplanted tissue.

Activity 6. Short Problems on Immunity

1. Why is the Rh factor an important factor to worry about in a woman's second pregnancy, rather than her first?

2. Why is memory of the immune system important?
3. Two children are exposed to chicken pox, and one has been vaccinated while the other has not. How will their immune responses differ to the exposure?
4. Give an example of active immunity. Compare this to passive immunity.
5. Pregnant women are encouraged to breast feed their newborn babies. In terms of immunity, why is this important for the newborn's health?
6. How many classes of antibodies are there? Describe each class.
7. What is meant by nonspecific or specific immune response? How do the two types of immune responses work together to protect the body?

Activity 7. Gas Exchange Paragraph

Write down five sentences that come to mind when you think about gas exchange. Share your statements with 1 or 2 people near you. What did you have in common? What was different?

Activity 8. Gas Exchange Story

Using the list of words given below, in a small group of 2 or 3, write a story about the evolution of the respiratory system over time. You may include any additional words or concepts as you write your story. Be prepared to share your story with the larger group.

Adaptations	Inhalation
Respiratory surface	Exhalation
Tracheal tubes	Alveoli
Gills	Oxygen
Lungs	Diaphragm
Vertebrates	Surface area
Aquatic	Terrestrial