

# CIRCULATION OF THE BLOOD

NAME \_\_\_\_\_ SCHOOL \_\_\_\_\_

DATE STARTED \_\_\_\_\_ DATE COMPLETED \_\_\_\_\_

**PREREQUISITE:** Microscope Basics course or ability to use a microscope.

**HOW TO DO THIS COURSE:** Do the steps one at a time, in order. When you finish a step, put your initials and the date on the sign-off line on the right. A split line means to get a pass (and an initial) from another student (or your academic supervisor if it says that). A \* means get a checkout. Essays are turned in to the academic supervisor.

**PURPOSE:** Learn how the blood circulates and takes care of the cells of the body.

**ESTIMATED TIME:** 12–15 hours.

## MATERIALS NEEDED FOR THIS COURSE

Data Sheet (DS) #8229 Circulation of the Blood Worksheets (to be attached to the back of this study guide)

Study booklet, *Circulation of the Blood*, with these data sheets:

1722      1723      1720      1721      1724      1725      1729      1727

back pocket: 1726 Lung Overlays (transparency)      1728 Circulatory System Overlays (transparency)

Exams: 2414, 8230 (answers), 7222 (review), 8231 (answers)

### Other materials:

Microscope, prepared slide of onion cells (for this and other biological materials mentioned below, consult a biological supplier such as Carolina Biological Supply Co.), color pictures of red blood cells and white blood cells, or Internet images (for Step A.8 a prepared slide of red blood cells may be substituted); raw chicken leg bone (broken open); bright light bulb; red and blue marking pencils or pens; a dissection kit and a double-injected animal specimen (such as frog, rat, etc.) showing arteries and veins in different colors or a life-size color picture of dissected animal); stethoscope; watch that displays seconds; 6 red buttons, 6 blue buttons, 1 large pink button; plastic heart model; masking tape for making labels; dissecting needle or ice pick; roll of butcher paper.

## A. BLOOD CELLS

1. READ: Data Sheet (DS) #1722 Cells. \_\_\_\_\_
2. DEMONSTRATE: Look at a prepared slide of onion cells with a microscope. Find the nucleus of an onion cell. \_\_\_\_\_
3. DEMONSTRATE: What a cell needs to live and survive. \_\_\_\_\_
4. DEMONSTRATE USING CLAY: How the body of a living thing is made of cells. \_\_\_\_\_
5. READ: DS #1723 Blood, "Section 1." \_\_\_\_\_
6. DEMONSTRATE: Show what blood plasma does. \_\_\_\_\_
- \*7. READ: DS #1723 Blood, "Section 2." \_\_\_\_\_

8. DEMONSTRATE: Look at a prepared slide of red blood cells with a microscope, or look at a color picture. (On Google you could click on “Images,” then type in *red blood cells*.) \_\_\_\_\_
9. DEMONSTRATE USING CLAY: The purpose of rbc’s. \_\_\_\_\_
- \*10. READ: DS #1723 Blood, “Section 3.” \_\_\_\_\_
11. DEMONSTRATE: Look at a picture of white blood cells. (On Google you could click on “Images,” then type in *white blood cells*.) \_\_\_\_\_
12. DEMONSTRATE USING CLAY: The purpose of white blood cells. \_\_\_\_\_
- \*13. READ: DS #1723 Blood, “Section 4.” \_\_\_\_\_
14. DEMONSTRATE: Show what a blood clot does and how it is formed. \_\_\_\_\_
- \*15. READ: DS #1723 Blood, “Section 5.” \_\_\_\_\_
16. DEMONSTRATE: Look at a broken chicken leg bone. With a dissecting needle<sup>1</sup> or pick scrape out a little of the marrow. \_\_\_\_\_

## B. BLOOD CIRCULATION

1. READ: DS #1720 Circulation—Blood Flowing in a Circle. \_\_\_\_\_
2. DEMONSTRATE: Blood circulation. \_\_\_\_\_
- \*3. READ: DS #1721 Blood Vessels, “Section 1.” \_\_\_\_\_
4. DEMONSTRATE: Show the difference between what arteries do and what veins do. \_\_\_\_\_
5. DEMONSTRATE: Show what capillaries do. \_\_\_\_\_
6. DEMONSTRATE: Hold your fingers close to a bright light bulb. Notice that the edges of your fingers are red. They are colored red from the blood circulating through the capillaries in your fingers. \_\_\_\_\_
7. READ: DS #1721 Blood Vessels, “Section 2.” \_\_\_\_\_
8. DEMONSTRATE: Point to the right side of your heart and then the left side of your heart. Find out where your lungs are if you don’t know. Then, using the data from Section 2, trace on your body a possible path of your blood from the right side of your heart to the left side of your heart. \_\_\_\_\_

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<sup>1</sup> **dissecting needle:** a special long thick needle with a handle, for use in examining parts of animals or plants.

Then trace a possible path of your blood from the left side of your heart back to the right side of your heart.

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\*9. READ: DS #1721 Blood Vessels, “Section 3.”

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10. DEMONSTRATE: Show why some blood is bright red and other blood is dark red.

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\*11. READ: DS #1721 Blood Vessels, “Section 4.”

\_\_\_\_\_

12. DEMONSTRATE: Find DS #8229 Circulation of the Blood Worksheets, attached to the back of this study guide. Pull off Worksheet 1, and label arteries, veins and capillaries. Color the blood red if oxygen-rich, blue if carbon dioxide-rich. Try to do it without looking at the illustration in Section 4. Save the worksheet for use below.

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13. PRACTICAL APPLICATION: Look at a preserved animal specimen that has been injected with dye to show arteries and veins. Find at least one artery and one vein. Use dissecting needles and a small knife if needed. Or look at a full-size color picture of an animal that shows an artery and vein.

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14. READ: DS #1721 Blood Vessels, “Section 5” and “Section 6.”

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15. DEMONSTRATE: Using Worksheet 1, label the aorta, and lower vena cava (the upper vena cava isn’t shown).

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## C. THE HEART

1. READ: DS #1724 The Heart Part 1, “Section 1.”

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2. PRACTICAL APPLICATION: Get a stethoscope and a watch that shows seconds. Listen to your heart with a stethoscope and count your heart rate. To measure your heart rate, either count the number of times your heart beats in a minute (each “lub-dub”) or count the number of times your heart beats in exactly 15 seconds and multiply by 4. Write your heart rate here \_\_\_\_\_.

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\*3. READ: DS #1724 The Heart Part 1, “Section 2.”

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4. DEMONSTRATE: Show each of the steps of blood moving through an upper and lower chamber of a heart.

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\*5. READ: DS #1724 The Heart Part 1, “Section 3.”

\_\_\_\_\_

6. DEMONSTRATE: Place a blank sheet of white paper on your table. Then take out Lung Overlay 1 and 2 from the pocket in the back of the study booklet. Place the overlays on top of the sheet of paper so that the

outlines of the lung exactly match. Notice how the lung arteries and veins overlap. They are connected by capillaries which are not shown. (If you want to, hold them up to the light instead of viewing them on a blank sheet of paper.) When you are finished, put them back into their pocket.

7. DEMONSTRATE: How blood flows through the right heart to the left heart and out toward the body. \_\_\_\_\_
8. READ: DS #1725 The Heart Part 2, "Section 1." \_\_\_\_\_
- \*9. READ: DS #1725 The Heart Part 2, "Section 2." \_\_\_\_\_
10. DEMONSTRATE USING CLAY: The steps of blood flow through the right heart. \_\_\_\_\_
- \*11. READ: DS #1725 The Heart Part 2, "Section 3." \_\_\_\_\_
12. DEMONSTRATE USING CLAY: The steps of blood flow through the left heart. \_\_\_\_\_
- \*13. READ: DS #1725 The Heart Part 2, "Section 4." \_\_\_\_\_
14. DEMONSTRATE: Pull off Worksheet 2 from the back of your study guide. Cut out the two halves of the heart and fit them together. \_\_\_\_\_
15. DEMONSTRATE: Pull off Worksheet 3, and draw arrows to show the flow of blood through the heart. Use blue arrows to show carbon dioxide-rich blood and red arrows to show oxygen-rich blood. Try to do this without looking at the illustrations in Section 4. \_\_\_\_\_
16. DRILL: Make a three-foot drawing like the full-length drawing in Section 1 of DS #1725 The Heart Part 2. Label all the parts and color them. Show how a blood cell would travel from the lower body to the upper body and back again to the lower body. **Supervisor pass.** \_\_\_\_\_
17. DRILL: Get six red buttons and label them "O" for oxygen. Get six blue buttons and label them "CO<sub>2</sub>" (pronounced "C O 2"). This is a short way for writing carbon dioxide. Label a large pink button "rbc" for red blood cell and place it in the lower body of your drawing from the last step. Put three "O" buttons in each lung, three "CO<sub>2</sub>" buttons in the upper body, two "CO<sub>2</sub>" buttons in the lower body, and one "CO<sub>2</sub>" button on the pink rbc.  
  
Show how the rbc gets to the upper body and back to the lower body, picking up and dropping off oxygen and carbon dioxide in the correct places. Here are the rules:
  - a) The rbc cannot be moved without carrying a red or blue button.

b) Red buttons cannot travel in the rbc when the blue buttons are there and blue buttons cannot travel in the rbc when the red buttons are there. \_\_\_\_\_

18. READ: DS #1725 The Heart Part 2, "Section 5." \_\_\_\_\_

19. DEMONSTRATE: Find the coronary arteries and veins on a plastic heart model. \_\_\_\_\_

20. DEMONSTRATE: Show how the heart muscle is fed and gets rid of its wastes. \_\_\_\_\_

21. PRACTICAL APPLICATION: Compare a plastic model of a heart with the drawings in DS #1725 The Heart Part 2. Using masking tape, label the following parts on the model:

aorta	pulmonary artery to right lung*
upper vena cava	pulmonary veins from right lung*
lower vena cava	pulmonary veins from left lung*
coronary arteries	pulmonary artery to left lung*
coronary veins	

**Supervisor pass.** (Take the tape off the model after you pass.) \_\_\_\_\_

\* Some models do not show well the arteries and veins that are attached to the heart. If your model shows where a blood vessel attaches to the heart but not the vessel itself, just label where the blood vessel should attach to the heart.

## D. PULSE

1. READ: DS #1729 Pulse. \_\_\_\_\_

2. DEMONSTRATE: Show two meanings of "pulse." \_\_\_\_\_

3. PRACTICAL APPLICATION: Take your pulse. Then listen to your heart with a stethoscope and take your pulse at the same time. Compare them: do the beats come at the same time exactly? Are the rates the same? \_\_\_\_\_

4. PRACTICAL APPLICATION: Take your pulse. Then run in place for a minute and take it again. Was there a difference in your pulse rate immediately after running? Write what happened in a report and explain what is happening in your body that might make a difference in pulse rate necessary after running. **Supervisor pass.** \_\_\_\_\_

## E. OTHER BODY SYSTEMS

1. READ: DS #1727 The Circulatory System and Other Body Systems, "Section 1." \_\_\_\_\_

2. DEMONSTRATE: Show how the circulatory system interacts with the respiratory system. \_\_\_\_\_
  - \*3. READ: DS #1727 The Circulatory System and Other Body Systems, "Section 2." \_\_\_\_\_
  4. DEMONSTRATE: Show how the circulatory system interacts with the digestive system. \_\_\_\_\_
  5. ESSAY: Explain why the liver receives a vein from the intestines as well as an artery from the aorta. \_\_\_\_\_
  - \*6. READ: DS #1727 The Circulatory System and Other Body Systems, "Section 3." \_\_\_\_\_
  7. DEMONSTRATE: How the circulatory system interacts with the excretory system. \_\_\_\_\_
  8. DRILL: Using your model heart and the three Circulatory System Overlays (in the pocket of the study booklet), practice finding these parts of the body and parts of the circulatory system. When you are ready, have another student check you. You pass when you can point out every part asked for without having to think about it (and without looking at the labels). When you are finished with the overlays, put them back into the pocket.
- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>right lower chamber (heart)</li> <li>left upper chamber (heart)</li> <li>venae cavae</li> <li>liver</li> <li>artery to intestines</li> <li>vein to liver</li> <li>kidneys</li> <li>aorta</li> <li>left pulmonary veins</li> <li>right pulmonary veins</li> <li>stomach</li> <li>vein from liver</li> <li>artery to liver</li> </ul> | <ul style="list-style-type: none"> <li>right upper chamber (heart)</li> <li>left lower chamber (heart)</li> <li>upper vena cava</li> <li>lower vena cava</li> <li>two arteries to upper body and arms</li> <li>arteries to kidneys</li> <li>veins from kidneys</li> <li>right pulmonary artery</li> <li>left pulmonary artery</li> <li>two arteries to head</li> <li>veins from head</li> <li>intestines</li> <li>lungs</li> </ul> |
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## F. FINAL SECTION

1. PRACTICAL APPLICATION: Make a drawing of the circulatory system on a piece of butcher paper that is as big as you are. Color the vessels and label the heart, lungs, liver, stomach, intestines, kidneys and major veins and arteries you have learned.

With pieces of clay to represent rbc's, oxygen, carbon dioxide, cell food and cell wastes, show the path of blood from the heart to the lungs to the body and back to the heart. Show all the main paths the blood can take as it circulates through the body and tell what it does at each stop. (Note that the rbc's carry oxygen and carbon dioxide, but blood plasma carries rbc's, cell food and other cell wastes.) **Supervisor pass.** \_\_\_\_\_

I have completed the steps of this course. I understand what I studied and can use it.

Student \_\_\_\_\_ Date \_\_\_\_\_

The student has completed the steps of this course and knows and can apply what was studied.

Academic supervisor \_\_\_\_\_ Date \_\_\_\_\_

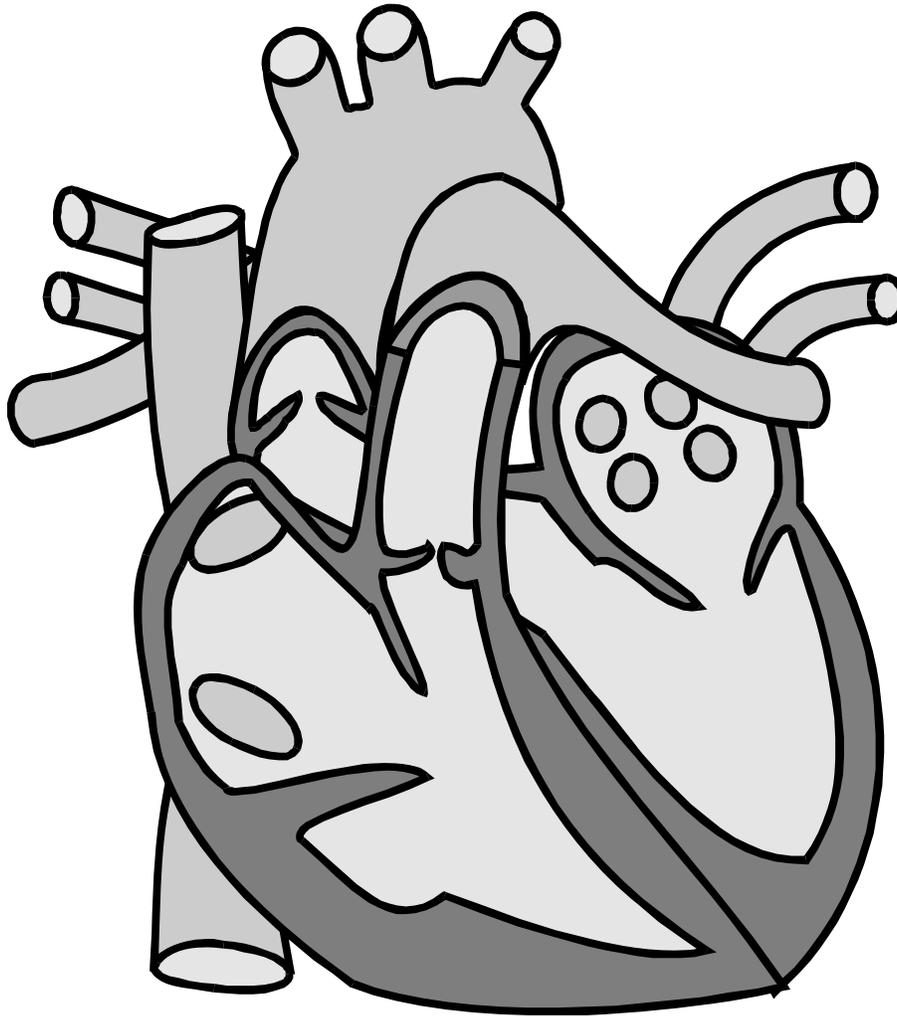
The student has passed the exam for this course.

Examiner \_\_\_\_\_ Date \_\_\_\_\_



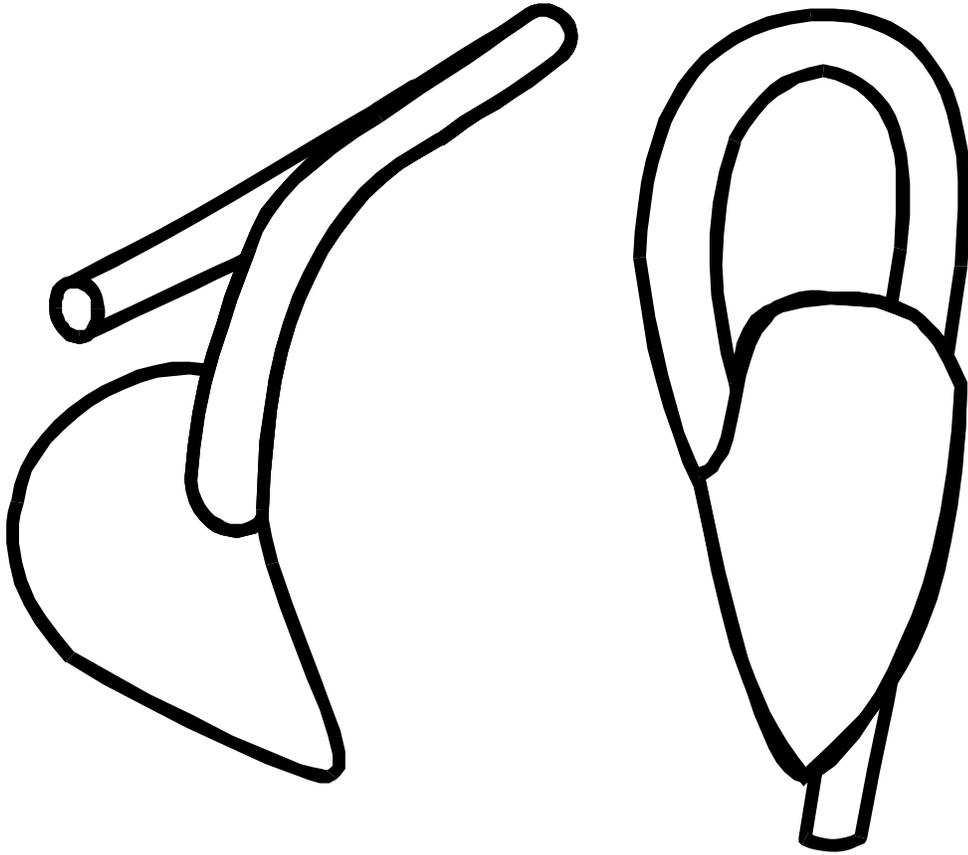
# CIRCULATION OF THE BLOOD WORKSHEETS

## WORKSHEET 3



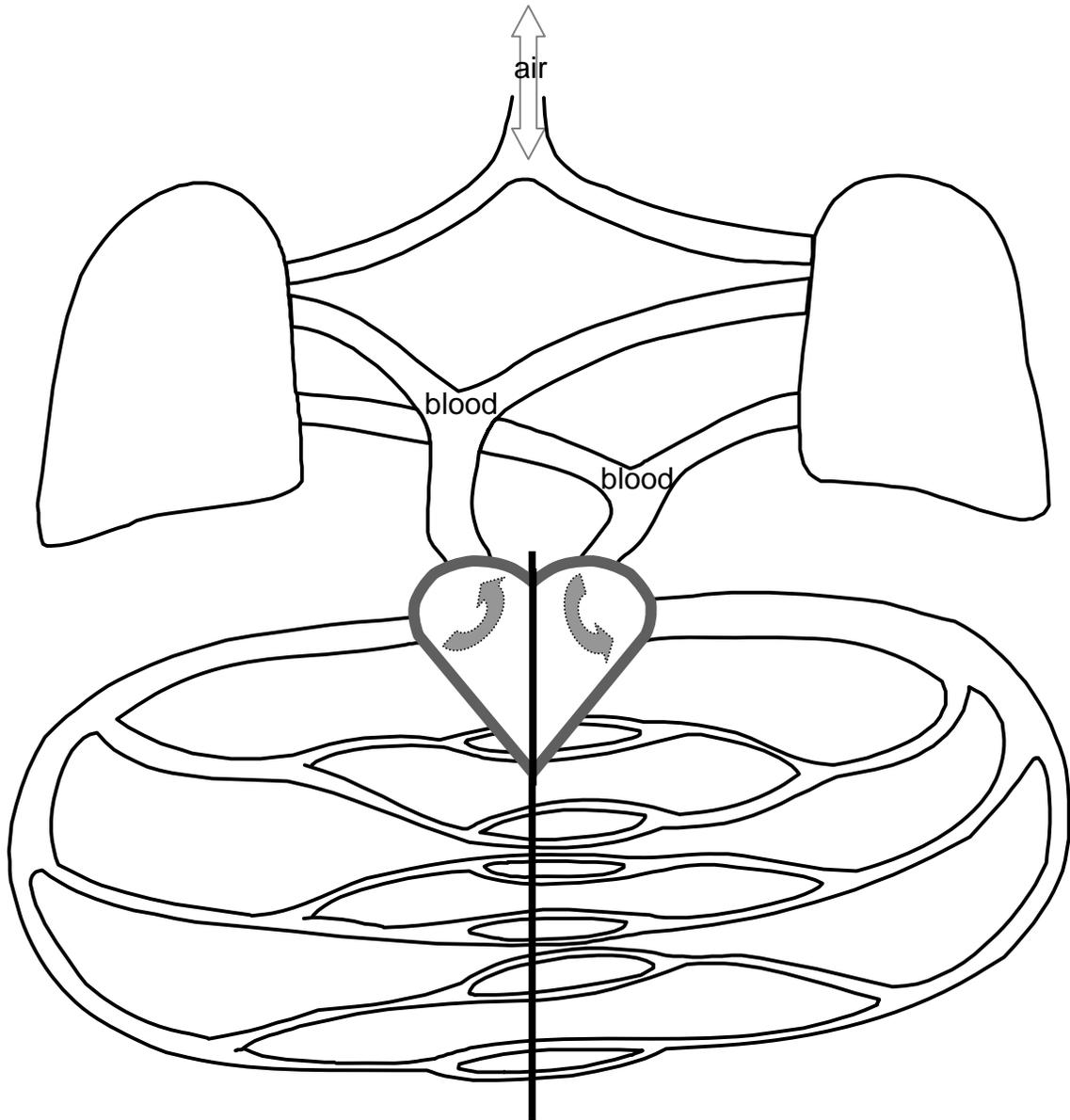


# WORKSHEET 2





# WORKSHEET 1



This diagram shows how the lungs, heart and circulatory system are connected, but the heart and lungs are actually much closer together than shown.