ACTIVITY 6-3. PARTS OF THE HUMAN CIRCULATORY SYSTEM

Humans have a closed circulatory system consisting of a four-chambered heart and a highly complex system of vessels, including arteries, veins, and capillaries.

The human heart is a muscular, four-chambered organ about the size of a fist. The two upper chambers—the atria (singular, atrium)—receive blood from the body, while the two lower chambers—the ventricles—pump blood out to the body by the force of their contractions.

Questions
1. Label the parts indicated in the diagram below.

2. In the human body, the heart is located in the thoracic/cHEST cavity.

3. The human heart is protected by a membrane called the pericardium.

4. The structure that separates the right and left sides of the heart is the septum.

5. What prevents the backflow of blood from the ventricles into the atria? valves
6. What is the normal range of heartbeat rates for an adult at rest? 70-72

7. What controls the rate of the heartbeat? pacemaker(sinoatrial node)

8. What type of muscle is found in the heart? cardiac muscle/myocardium

arteries Arteries are vessels that carry blood away from the heart. They have thick elastic walls containing a layer of smooth muscle. The elasticity of the walls enables the vessels to expand and contract with the pulse of blood from the heart. Most arteries are found deep within the body. Large arteries branch, forming smaller and smaller vessels, eventually dividing into arterioles and then capillaries.

Questions
1. Describe the structure of arteries. Thick wall (Connective tissue, Smooth muscle, endothelium)

2. The largest artery in the body is the aorta.

3. The smallest arteries are called arteriole.

4. Do arteries carry blood toward or away from the heart? Name any exceptions. Away None

5. Do arteries carry oxygenated or deoxygenated blood? Name any exceptions. Oxygenated Pulmonary artery

6. What is the pulse? Heart beat

7. What is "hardening" of the arteries? Atherosclerosis, lipid deposits on the wall

capillaries Capillaries are microscopic vessels whose walls are only one cell thick. They connect the smallest arteries (arterioles) with the smallest veins (venules). All body cells are relatively close to a capillary. The exchange of needed materials from the blood and waste materials from the cells takes place through the capillary walls.
Questions

1. Describe the structure of a capillary wall. How does it compare with the structure of the wall of an arteriole? One cell thick, it doesn't have smooth muscle & connective tissue.

2. Describe the exchanges of materials that occur through the capillary wall. $O_2$ & $CO_2$ are exchanged. Diffusion

3. By what processes do these exchanges occur? Diffusion

4. From what type of vessel does a capillary receive blood? To what type of vessel does a capillary transport blood? Arteriole, Venule.

Veins Veins carry blood to the heart. The walls of these vessels are thinner than those of the arteries because they contain less muscle tissue. The movement of the blood in the veins is helped along by the contraction of muscles and by breathing movements. Veins contain valves that prevent the backflow of blood.

Questions

1. Describe the structure of a vein. Thinner than arteries, made up of connective tissue and muscle

2. Do veins carry blood toward or away from the heart? Describe any exceptions. Toward None

3. Do veins carry oxygenated or deoxygenated blood? Describe any exceptions. Deoxygenated // Pulmonary vein

4. Why is there no "pulse" in veins? The pressure from heart is lessened by capillaries.

5. Label the three types of blood vessels drawn below.

[Diagram of blood vessels]
ACTIVITY 6-4. PATHWAYS OF CIRCULATION

The idea that the pathway of the blood in the body was a closed, one-way circuit was first presented by the English physician William Harvey. In his book, published in 1628, he stated that the blood must flow from the heart through the arteries to the veins and back to the heart. But without the compound microscope, he could not see the connection between the two types of vessels. Capillaries were first seen by the Italian physiologist Marcello Malpighi in the early 1660s.

Question

Label the parts indicated in the drawing of the circulatory system below.

**PULMONARY CIRCULATION**

Blood leaving the right ventricle of the heart passes through the pulmonary arteries to the lungs. Within the capillaries of the lungs the blood gives up carbon dioxide and picks up oxygen, returning to the left atrium of the heart through the pulmonary veins. This path from the heart to the lungs and back again is the pulmonary circulation.
Questions

1. Label the structures indicated on the diagram below.

2. Describe the pathway of the blood from the point where it enters the right atrium until it leaves the left ventricle.
   \[\text{Right atrium} \rightarrow \text{Right ventricle} \rightarrow \text{Lungs} \rightarrow \text{Left atrium}\]

3. Describe the exchange of respiratory gases that occurs in the capillaries of the lungs.
   \[\text{O}_2 \text{ is picked up by blood and \text{Left ventricle}}\]
   \[\text{CO}_2 \text{ is dropped off in lungs}\]

SYSTEMIC CIRCULATION

Blood leaving the left ventricle enters the aorta and passes from there to all parts of the body (except the lungs), eventually returning to the heart. This is the systemic circulation. Smaller arteries branch off the aorta and carry blood to particular parts of the body. Specific subdivisions of the systemic circulation are the coronary, portal, and renal circulations.

Questions

1. The part of the body *not* served by the systemic circulation is the **lungs**.

2. The vessel that returns blood from the head and neck to the right atrium of the heart is the **Superior vena cava**.

3. The vessel that returns blood from the lower portion of the body to the right atrium of the heart is the **Inferior vena cava**.
4. Fill in the blanks in the table below.

<table>
<thead>
<tr>
<th>Artery</th>
<th>Area Served</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid artery</td>
<td>Head</td>
</tr>
<tr>
<td>Subclavian artery</td>
<td>chest</td>
</tr>
<tr>
<td>Femoral artery</td>
<td>thigh/leg</td>
</tr>
<tr>
<td>Tibial artery</td>
<td>calves</td>
</tr>
<tr>
<td>Hepatic artery</td>
<td>liver</td>
</tr>
<tr>
<td>Gastric artery</td>
<td>stomach</td>
</tr>
<tr>
<td>Mesenteric artery</td>
<td>mesentery</td>
</tr>
<tr>
<td>Renal artery</td>
<td>Kidneys</td>
</tr>
</tbody>
</table>

The right and left coronary arteries, which branch off the aorta just after it leaves the heart, provide the blood supply to the heart itself. Since the heart muscle works continuously throughout life, it requires a constant supply of oxygen and nutrients. If this supply is blocked, even temporarily, by a clot or a narrowing of the arteries, the heart muscle cells begin to die. This is commonly called a heart attack. Deoxygenated blood from the heart muscle is returned to the circulation by veins that open directly into the heart chambers.

Questions

1. What is the function of the coronary circulation?
   
   It brings blood to the heart

2. From which major vessel do the coronary arteries arise?
   
   From the aorta

3. What happens if there is a blockage of the coronary circulation?
   
   Heart attack
The portal vein carries blood from the small intestine and other digestive organs directly to the liver. After a meal, blood reaching the liver contains high concentrations of glucose and other nutrients. The liver removes excess nutrients from the blood before the blood is returned to the heart and to the general circulation. This is one of the ways in which the concentrations of glucose and other nutrients in the blood are kept within a relatively narrow range.

Questions

1. Label the parts indicated in the diagram below.

2. Using arrows, indicate the pathway of the blood in the portal circulation.

3. What important function is served by the portal circulation?

4. What vessel carries blood away from the liver? How is this blood returned to the heart?

Hepatic vein → Inferior vena cava
LYMPHATIC DRAINAGE:
OF THE HUMAN BODY

LYMPH NODES

THORACIC DUCT

RIGHT SUBCLAVIAN VEIN

LEFT SUBCLAVIAN VEIN
The kidneys are served by the renal arteries, large vessels that branch directly off the aorta. Within the kidneys, the arteries branch into a fine network of capillaries. As the blood passes through the capillaries, metabolic wastes are filtered out. Blood leaves the kidneys through the renal veins, returning to the heart via the inferior vena cava.

Questions
1. What vessels carry blood to the kidneys? Renal Artery
2. What vessels return blood from the kidneys to the heart? Renal vein

LYMPHATIC SYSTEM

Lymph is a fluid that bathes all the cells of the body. It is also called tissue fluid or intercellular fluid. Lymph consists mainly of fluid that escapes from the blood through the walls of the capillaries. It is similar in composition to the blood plasma. The exchange of materials between the blood and the tissue cells takes place through the lymph.

Tiny lymphatic capillaries originate in all the tissues of the body. Lymphatic vessels are thin-walled structures that contain valves to prevent backflow. The lymph is moved through the vessels by muscle contractions and breathing movements. Small lymph vessels merge, forming larger and larger vessels. Eventually, all lymph passes into either the thoracic duct or the right lymph duct. These large collecting vessels return the lymph to the circulatory system, where they enter large veins just below the neck.

At intervals along the lymphatic vessels there are beadlike enlargements called lymph nodes, or lymph glands. Within these structures white blood cells, some of which are produced in the lymph nodes, remove bacteria and other foreign particles from the lymph.

Questions
1. Label the parts indicated on the diagram below.
2. What are the functions of the lymph and the lymphatic vessels?

- site for cell exchange
- carries lymph fluid

3. Where does lymph come from, and how is it drained from the tissues?

Blood pressure and lymph vessels pick up excess lymph fluid.

4. At what points are the lymphatic system and the circulatory system connected?

Right lymphatic duct and thoracic duct.

5. What special function is served by the lymphatic vessels that serve the villi of the small intestine?

Lacteals absorb fat products that were digested in the small intestine.

6. What may happen to the lymph nodes in the area of an infection in the body?

It specializes the T cells and B cells to fight off specific infections.
ACTIVITY 6-3. PARTS OF THE HUMAN CIRCULATORY SYSTEM

Humans have a closed circulatory system consisting of a four-chambered heart and a highly complex system of vessels, including arteries, veins, and capillaries.

The human heart is a muscular, four-chambered organ about the size of a fist. The two upper chambers—the atria (singular, atrium)—receive blood from the body, while the two lower chambers—the ventricles—pump blood out to the body by the force of their contractions.

Questions
1. Label the parts indicated in the diagram below.

2. In the human body, the heart is located in the thoracic/cHEST cavity.

3. The human heart is protected by a membrane called the pericardium.

4. The structure that separates the right and left sides of the heart is the septum.

5. What prevents the backflow of blood from the ventricles into the atria?
6. What is the normal range of heartbeat rates for an adult at rest? 70 - 72

7. What controls the rate of the heartbeat? **Pacemaker (sinoatrial node)**

8. What type of muscle is found in the heart? **Cardiac muscle / myocardium**

**Arteries** - Arteries are vessels that carry blood away from the heart. They have thick elastic walls containing a layer of smooth muscle. The elasticity of the walls enables the vessels to expand and contract with the pulse of blood from the heart. Most arteries are found deep within the body. Large arteries branch, forming smaller and smaller vessels, eventually dividing into arterioles and then capillaries.

**Questions**

1. Describe the structure of arteries.  
   Thick walled (Connective tissue, Smooth muscle, endothelin)

2. The largest artery in the body is the **aorta**.

3. The smallest arteries are called **arteriole**.

4. Do arteries carry blood toward or away from the heart? Name any exceptions.  
   Away  
   None

5. Do arteries carry oxygenated or deoxygenated blood? Name any exceptions.  
   Oxygenated  
   Pulmonary artery

6. What is the pulse?  
   Heartbeat

7. What is "hardening" of the arteries?  
   **Atherosclerosis**, lipid deposits on the wall

**Capillaries** - Capillaries are microscopic vessels whose walls are only one cell thick. They connect the smallest arteries (arterioles) with the smallest veins (venules). All body cells are relatively close to a capillary. The exchange of needed materials from the blood and waste materials from the cells takes place through the capillary walls.
Questions

1. Describe the structure of a capillary wall. How does it compare with the structure of the wall of an arteriole? One cell thick, it doesn't have smooth muscle and connective tissue.

2. Describe the exchanges of materials that occur through the capillary wall. O₂ and CO₂ are exchanged.

3. By what processes do these exchanges occur? Diffusion.

4. From what type of vessel does a capillary receive blood? To what type of vessel does a capillary transport blood? Arteriole, Venule.

Veins carry blood to the heart. The walls of these vessels are thinner than those of the arteries because they contain less muscle tissue. The movement of the blood in the veins is helped along by the contraction of muscles and by breathing movements. Veins contain valves that prevent the backflow of blood.

Questions

1. Describe the structure of a vein. Thinner than arteries, less connective tissue and muscle.

2. Do veins carry blood toward or away from the heart? Describe any exceptions. Toward


4. Why is there no "pulse" in veins? The pressure from heart is lessened by capillaries.

5. Label the three types of blood vessels drawn below.

[Diagram of Artery, Vein, Capillary]
ACTIVITY 6-4. PATHWAYS OF CIRCULATION

The idea that the pathway of the blood in the body was a closed, one-way circuit was first presented by the English physician William Harvey. In his book, published in 1628, he stated that the blood must flow from the heart through the arteries to the veins and back to the heart. But without the compound microscope, he could not see the connection between the two types of vessels. Capillaries were first seen by the Italian physiologist Marcello Malpighi in the early 1660s.

Question

Label the parts indicated in the drawing of the circulatory system below.

_{PULMONARY CIRCULATION}_

Blood leaving the right ventricle of the heart passes through the _pulmonary arteries_ to the lungs. Within the capillaries of the lungs the blood gives up carbon dioxide and picks up oxygen, returning to the left atrium of the heart through the _pulmonary veins_. This path from the heart to the lungs and back again is the _pulmonary circulation_.

98
Questions

1. Label the structures indicated on the diagram below.

   Superior vena cava
   Pulmonary artery
   Inferior vena cava
   Pulmonary vein
   Lung

2. Describe the pathway of the blood from the point where it enters the right atrium until it leaves the left ventricle.

   Right atrium → Right ventricle → Lungs → Left atrium → Left ventricle

3. Describe the exchange of respiratory gases that occurs in the capillaries of the lungs.

   O₂ is picked up by blood and CO₂ is dropped off in lungs

SYSTEMIC CIRCULATION

Blood leaving the left ventricle enters the aorta and passes from there to all parts of the body (except the lungs), eventually returning to the heart. This is the systemic circulation. Smaller arteries branch off the aorta and carry blood to particular parts of the body. Specific subdivisions of the systemic circulation are the coronary, portal, and renal circulations.

Questions

1. The part of the body not served by the systemic circulation is the ______ ______.

2. The vessel that returns blood from the head and neck to the right atrium of the heart is the ______ ______ vena cava

3. The vessel that returns blood from the lower portion of the body to the right atrium of the heart is the ______ ______ vena cava
4. Fill in the blanks in the table below.

<table>
<thead>
<tr>
<th>ARTERY</th>
<th>AREA SERVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid artery</td>
<td>Head</td>
</tr>
<tr>
<td>Subclavian artery</td>
<td>chest</td>
</tr>
<tr>
<td>Femoral artery</td>
<td>thigh leg</td>
</tr>
<tr>
<td>Tibial artery</td>
<td>calves</td>
</tr>
<tr>
<td>Hepatic artery</td>
<td>liver</td>
</tr>
<tr>
<td>Gastric artery</td>
<td>stomach</td>
</tr>
<tr>
<td>Mesenteric artery</td>
<td>intestines</td>
</tr>
<tr>
<td>Renal artery</td>
<td>Kidneys</td>
</tr>
</tbody>
</table>

Coronary circulation

The right and left coronary arteries, which branch off the aorta just after it leaves the heart, provide the blood supply to the heart itself. Since the heart muscle works continuously throughout life, it requires a constant supply of oxygen and nutrients. If this supply is blocked, even temporarily, by a clot or a narrowing of the arteries, the heart muscle cells begin to die. This is commonly called a heart attack. Deoxygenated blood from the heart muscle is returned to the circulation by veins that open directly into the heart chambers.

Questions

1. What is the function of the coronary circulation?
   It brings blood to heart.

2. From which major vessel do the coronary arteries arise?
   From the aorta.

3. What happens if there is a blockage of the coronary circulation?
   Heart attack.
The portal vein carries blood from the small intestine and other digestive organs directly to the liver. After a meal, blood reaching the liver contains high concentrations of glucose and other nutrients. The liver removes excess nutrients from the blood before the blood is returned to the heart and to the general circulation. This is one of the ways in which the concentrations of glucose and other nutrients in the blood are kept within a relatively narrow range.

Questions

1. Label the parts indicated in the diagram below.

2. Using arrows, indicate the pathway of the blood in the portal circulation.

3. What important function is served by the portal circulation?

4. What vessel carries blood away from the liver? How is this blood returned to the heart?

Hepatic vein → Inferior Vena Cava
LYMPHATIC DRAINAGE OF THE HUMAN BODY

LYMPH NODES

THORACIC DUCT

RIGHT SUBCLAVIAN VEIN

LEFT SUBCLAVIAN VEIN
The kidneys are served by the renal arteries, large vessels that branch directly off the aorta. Within the kidneys, the arteries branch into a fine network of capillaries. As the blood passes through the capillaries, metabolic wastes are filtered out. Blood leaves the kidneys through the renal veins, returning to the heart via the inferior vena cava.

Questions
1. What vessels carry blood to the kidneys? Renal Artery
2. What vessels return blood from the kidneys to the heart? Renal Vein

LYMPHATIC SYSTEM

Lymph is a fluid that bathes all the cells of the body. It is also called tissue fluid or intercellular fluid. Lymph consists mainly of fluid that escapes from the blood through the walls of the capillaries. It is similar in composition to the blood plasma. The exchange of materials between the blood and the tissue cells takes place through the lymph.

Tiny lymphatic capillaries originate in all the tissues of the body. Lymphatic vessels are thin-walled structures that contain valves to prevent backflow. The lymph is moved through the vessels by muscle contractions and breathing movements. Small lymph vessels merge, forming larger and larger vessels. Eventually, all lymph passes into either the thoracic duct or the right lymph duct. These large collecting vessels return the lymph to the circulatory system, where they enter large veins just below the neck.

At intervals along the lymphatic vessels there are beadlike enlargements called lymph nodes, or lymph glands. Within these structures white blood cells, some of which are produced in the lymph nodes, remove bacteria and other foreign particles from the lymph.

Questions
1. Label the parts indicated on the diagram below.
2. What are the functions of the lymph and the lymphatic vessels?
   - site for cell exchange
   - carries lymph fluid

3. Where does lymph come from, and how is it drained from the tissues?
   Blood, pressure, and lymph vessel pick up excess lymph

4. At what points are the lymphatic system and the circulatory system connected?
   Ducts - Right lymphatic duct

5. What special function is served by the lymphatic vessels that serve the villi of the small intestine?
   Lacteals absorb fat digested product

6. What may happen to the lymph nodes in the area of an infection in the body?
   It specializes to cell in fight of specific infections