4.3 Blood Flow Study Guide by Hisrich

4.3.a What types of muscle help move blood around the body?

The heart is the primary muscle that helps move blood & is made of cardiac muscle tissue. It is responsible for the circulation of blood & all the materials in it.

4.3.b What is the relationship between the heart and the lungs? 4.3.c What is the pathway of blood in and out of the heart in pulmonary and systemic circulation?

Pulmonary Circulation: The right side of the heart collects deoxygenated blood into its atrium & then passes it into the ventricle. The right ventricle then pushes the blood to the lungs, where the CO₂ is dropped off and O₂ is picked up.

Systemic Circulation: The blood from the lungs comes back to the left side of the heart through the left atrium. It then moves into the left ventricle and the ventricle pushes it out through the aorta (biggest artery) and into the rest of the arteries. The arteries carry oxygenated blood to all of the body’s tissues. As they reach the tissues, they turn into tiny arteries called arterioles, which then become capillaries. The capillaries are the place where oxygen, nutrients and hormones are dropped off and waste products are picked up. The capillaries then turn into venules, which turn into veins, which come together as the vena cava (biggest veins) and carry deoxygenated blood back into the right atrium of the heart.

4.3.d How do the structure of arteries, veins and capillaries relate to their function in the body? 4.3.e What unique features of veins help move blood back to the heart?

<table>
<thead>
<tr>
<th>Arteries</th>
<th>Capillaries</th>
<th>Veins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three layers of thick, fairly rigid walls to allow them to expand/contract &amp; to handle high pressure (blood has greatest pressure as it’s leaving the heart)—one layer is smooth muscle</td>
<td>Thin walled (one cell layer thick) &amp; microscopic in size to allow exchange of materials, often have pores to allow movement of materials</td>
<td>Three layers of elastic/collapsible walls with valves to prevent the backflow of blood as it moves toward the heart— one layer is smooth muscle</td>
</tr>
</tbody>
</table>

4.3.f What are varicose veins? 4.3.g Why don’t we ever hear about varicose arteries?

Varicose veins are big, twisty veins near the skin’s surface that are caused by weakened valves. When the valves don’t work (keep blood moving), blood collects in the veins and the pressure builds up, causing them to become weak, large and twisted. They can run in families, but are also caused by age, being overweight and standing for long periods of time.

Arteries don’t do this because they have higher pressure in them & therefore do not need valves to keep the blood moving.

4.3.h What are the major arteries and veins in the body and which regions do they serve?

<table>
<thead>
<tr>
<th>Major Arteries</th>
<th>Major Veins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aorta—blood is pushed out of the aorta by the left ventricle &amp; then the aorta branches into all other arteries in the body</td>
<td>Superior Vena Cava—carries deoxygenated blood from the upper body (arms and head) back to the heart</td>
</tr>
<tr>
<td>Coronary Artery—this is the artery that runs across the ventral side of the heart, nourishing the cardiac tissue itself</td>
<td>Inferior Vena Cava—carries deoxygenated blood from the lower body (abdomen and legs) back to the heart</td>
</tr>
<tr>
<td>Pulmonary Arteries—carry blood from the right ventricle to the lungs to pick up oxygen</td>
<td>Pulmonary Veins—carry newly oxygenated blood from the lungs back to the left atrium</td>
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</tbody>
</table>
4.3. i  What is cardiac output?  4.3. j  How does cardiac output help assess overall heart health?  4.3. k  How does an increased or decreased cardiac output impact the body?

Cardiac output is the volume of blood the heart pumps per minute (mL/min) out of the left side. It's calculated by multiplying heart rate (beats/min) by stroke volume (mL/beat). Stroke volume is how much blood is pushed out by the left ventricle with each beat. An average person has a resting heart rate of 70 beats/min and resting stroke volume of 70 mL/beat, leading to a typical cardiac output of 4,900 mL/min. The total volume of blood in an average person is 5,000 mL (5 L), so the whole volume of blood is pumped through the heart about once each minute. During vigorous exercise, it can increase 4-7 fold.

Normal cardiac output is needed to move oxygen and nutrients to all the body’s tissues. If a person’s cardiac output is lower than normal, the tissues can suffer or blood pressure can become unhealthy. An increased cardiac output from exercise can help strengthen the heart.

4.3. l  What is blood pressure?

Blood pressure is a measure of how fast the molecules in blood are hitting the walls of the arteries. It increases with increased blood volume & with increased heart rate. It is an important indicator of cardiac health and should be under 120/80 at rest.

4.3. m  How can the measurement of blood pressure in the legs be used to assess circulation?  4.3. n  What is peripheral artery disease?

The blood pressure in the legs can be taken to measure how well blood is circulating to those limbs. To take the pressure, a person listens to the pulse in that region. Arteriosclerosis (“abnormal condition of hard arteries”) & atherosclerosis (“hard arteries due to fat deposits”) can both impede blood flow by making the arteries more narrow (that’s atherosclerosis) and less flexible (that’s arteriosclerosis). That can lead to peripheral vascular disease (PAD), in which blood vessels supplying the extremities do not work as well as they should. The most extreme form of peripheral vascular disease is peripheral artery disease, in which there is partial or total blockage of an artery, usually one leading to an arm or leg. It causes pain and eventually can even lead to loss of partial or total limbs.

4.3. o  Why can smoking lead to peripheral artery disease?

Smoking raises the risk of atherosclerosis and therefore the risk of PAD. It’s thought to do so by damaging the endothelium (innermost layer of the artery), which allows plaque to build up on the artery walls.