18.4B: Distribution of Blood

Humans have a closed cardiovascular system, meaning that blood never leaves the network of arteries, veins, and capillaries.

Learning Objectives

• List the components of blood flow distribution

Key Points

• In humans, blood is pumped from the strong left ventricle of the heart through arteries to peripheral tissues and returns to the right atrium of the heart through veins.

• After blood returns to the right atrium, it enters the right ventricle and is pumped through the pulmonary artery to the lungs, then returns to the left atrium through the pulmonary veins. Blood then enters the left ventricle to be circulated through the systemic circulation again.

• The closing of blood vessels is termed vasoconstriction. Vasoconstriction occurs through contraction of the muscular walls of vessels and results in increased blood pressure.

• Vasoconstriction is important for minimizing acute blood loss in the event of hemorrhage as well as retaining body heat and regulating mean arterial pressure.

• Dilation, or opening of blood vessels, is termed vasodilation. Vasodilation occurs through relaxation of smooth muscle cells within vessel walls.

• Vasodilation increases blood flow by reducing vascular resistance. Therefore, dilation of arterial blood vessels (mainly arterioles) causes a decrease in blood pressure.
Key Terms

- **vasoconstriction**: The constriction of the blood vessels.
- **vascular resistance**: The resistance to flow that must be overcome to push blood through the circulatory system. The resistance offered by the peripheral circulation is known as the systemic vascular resistance (SVR), while the resistance offered by the vasculature of the lungs is known as the pulmonary vascular resistance (PVR).
- **vasodilation**: The dilation of the blood vessels.
- **mean arterial pressure**: The average arterial pressure during a single cardiac cycle.

Humans have a closed cardiovascular system, meaning that the blood never leaves the network of arteries, veins, and capillaries. Blood is circulated through blood vessels by the pumping action of the heart, pumped from the left ventricle through arteries to peripheral tissues and returning to the right atrium through veins. It then enters the right ventricle and is pumped through the pulmonary artery to the lungs and returns to the left atrium through the pulmonary veins. Blood then enters the left ventricle to be circulated again.

**Pulmonary circuit**: Diagram of pulmonary circulation. Oxygen-rich blood is shown in red; oxygen-depleted blood in blue.

Distribution of blood can be modulated by many factors, including increasing or decreasing heart rate and dilation or constriction of blood vessels.
Vasoconstriction

**Blood distribution**: Oxygenated arterial blood (red) and deoxygenated venous blood (blue) are distributed around the body.

Vasoconstriction is the narrowing of the blood vessels resulting from contraction of the muscular wall of the vessels, particularly the large arteries and small arterioles. The process is the opposite of vasodilation, the widening of blood vessels. The process is particularly important in staunching hemorrhage and acute blood loss. When blood vessels constrict, the flow of blood is restricted or decreased, thus retaining body heat or increasing vascular resistance. This makes the skin turn paler because less blood reaches the surface, reducing the radiation of heat.

On a larger level, vasoconstriction is one mechanism by which the body regulates and maintains mean arterial pressure. Substances causing vasoconstriction are called vasoconstrictors or vasopressors. Generalized vasoconstriction usually results in an increase in systemic blood pressure, but it may also occur in specific tissues, causing a localized reduction
in blood flow. The extent of vasoconstriction may be slight or severe depending on the substance or circumstance.

## Vasodilation

Vasodilation refers to the widening of blood vessels resulting from relaxation of smooth muscle cells within the vessel walls, particularly in the large veins, large arteries, and smaller arterioles. The process is essentially the opposite of vasoconstriction. When blood vessels dilate, the flow of blood is increased due to a decrease in vascular resistance. Therefore, dilation of arterial blood vessels (mainly the arterioles) causes a decrease in blood pressure. The response may be intrinsic (due to local processes in the surrounding tissue) or extrinsic (due to hormones or the nervous system). Additionally, the response may be localized to a specific organ (depending on the metabolic needs of a particular tissue, as during strenuous exercise), or it may be systemic (seen throughout the entire systemic circulation). Substances that cause vasodilation are termed vasodilators.

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