

Chapter 23 Notes – Circulation

23.1: **The circulatory system connects somatic cells through veins, arteries, and capillaries.**

- **Blood cells** diffuse from **capillaries** through the **interstitial fluid** into **tissue cells**.

23.2: Several variations of **internal transport** have evolved in animals.

- **Open circulatory systems** have evolved in mollusks and arthropods. It is open because blood is pumped through **open-ended vessels** that flow out among cells.
- **Closed circulatory systems** have evolved in earthworms, squids, octopuses, and vertebrates. The vertebrate circulatory system is a **cardiovascular system**, where the blood is confined to the **vessels**, keeping it distinct from the **interstitial fluid**.
- **Arteries** carry blood away from the **heart**. **Veins** carry the blood to the heart.
- **Capillaries** converge in **arterioles** and **venules**, which feed into arteries and veins respectively.

23.3: Vertebrate **cardiovascular systems** are products of evolution.

- **Double circulation** is the means by which a vigorous flow of blood is supplied to body organs.
- The **pulmonary circuit** carries blood between the heart and the gas exchange tissues in the lungs. The **systemic circuit** carries blood between the heart and the rest of the body.
- Reptiles have a three chambered heart (2 **atria**, 1 **ventricle**, while birds and mammals have a ventricle that is completely divided.

23.4 **The human heart and cardiovascular system** are typical of **mammals**.

- **Pulmonary arteries** and **pulmonary veins** carry blood between the heart and the lungs.
- **The superior and inferior vena cava** are veins that carry blood to the right atrium

23.5: The structure of **blood vessels** fits their function.

- The **left ventricle** is thicker than the right ventricle because blood needs to travel further.
- **Arteries** are thickly walled with smooth muscle tissue and connective tissue.
- **Veins** have **valves** to keep pushing blood forward, preventing **backflow**.

23.6: The **cardiac cycle**, consisting of **diastole** and **systole**, is the rhythmic relaxation and contraction of the heart

- During **diastole**, the heart is **relaxed** and the **AV Valves** are open for 0.4 seconds.
- During **systole**, the **atria contract** and then the **ventricles contract** as the **semilunar valves** open.
- **Cardiac output** is the volume of blood per minute that is pumped into the **systemic circuit** by the **left ventricle**.

23.7: **The heart's pacemaker (SA Node)** generates electrical signals that trigger the contraction of the atria and these signals are relayed to the ventricles by the **AV node**.

- The **SA Node** and **AV Node** ensure that the heart beats rhythmically. This could be seen on an **electrocardiogram**.

23.8: **Heart Attacks** are damage to the **cardiac muscle** usually resulting from a **blood clot** or **plaque** since the clot and plaque increase the **pressure** within the artery/vein.

- **Atherosclerosis** is a **cardiovascular disease** where the arteries grow plaques, which increase the pressure of the artery to the extent where the vessel can burst.

23.9: Blood exerts **pressure** on vessel walls.

- **Blood pressure** is the force that blood exerts against the walls of the blood vessels.
- The **pulse** is the rhythmic stretching of the **arteries**, where pressure is the greatest.

23.10: **Blood pressure** is an indicator of cardiovascular fitness; high blood pressure, **hypertension**, can lead to **cardiovascular problems**.

- **Hypertension** is a persistent **systolic blood pressure** at or above 140 mm Hg and/or a **diastolic blood pressure** higher than 90 mm Hg.

23.11: **Smooth muscle** controls the distribution of blood through **precapillary sphincters**.

- With **sphincters relaxed**, blood flows through the **capillaries**
- With **sphincters contracted**, blood flows through the **thoroughfare channel**.

23.12: **Capillaries** allow substances to **diffuse through** their walls.

- The **diffusion** maintains a **dynamic equilibrium** in both the capillary and interstitial fluid.

23.13: Blood is a mixture of **red** and **white blood cells** suspended in **plasma**.

- **Erythrocytes**, the red blood cells, are the most abundant cell type (5 – 6 million per μL [mm^3] of blood) and are responsible for the **transport of oxygen and carbon dioxide**.
- The body's white blood cells, **leukocytes**, are responsible for **defense and immunity**.
- **Leukocytes** consist of **Basophil, Eosinophil, Neutrophil, Lymphocyte**, and **Monocyte** cells.
- **Monocyte and Lymphocyte cells** are **phagocytes**, which **engulf** their own food (bad cells for the body) through **phagocytosis**.
- **Platelets** are vital to **blood clotting**.

23.14: **Blood cells** need be present in correct quantities.

- When the red blood cells count or hemoglobin count is too low, **anemia** results.
- A **negative – feedback mechanism** in the **bone marrow**, controls the **production of erythrocytes**.
- **Erythropoietin** is a hormone produced by the kidneys that stimulates the bone marrow to produce more red blood cells.

23.15: **Blood clots** form when vessels are injured

- The sealants of the **platelets** are made of **fibrinogen**, a plasma protein.

23.16: **Stem cells** may be able to cure blood cell diseases, such as **Leukemia**.

- **Stem cells** are non – specialized cells that differentiate into the body’s cells, including blood cells.
- **Leukemia** is the cancer of the white blood cells, **leukocytes**.