Cardiovascular dynamics

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Lecture 4

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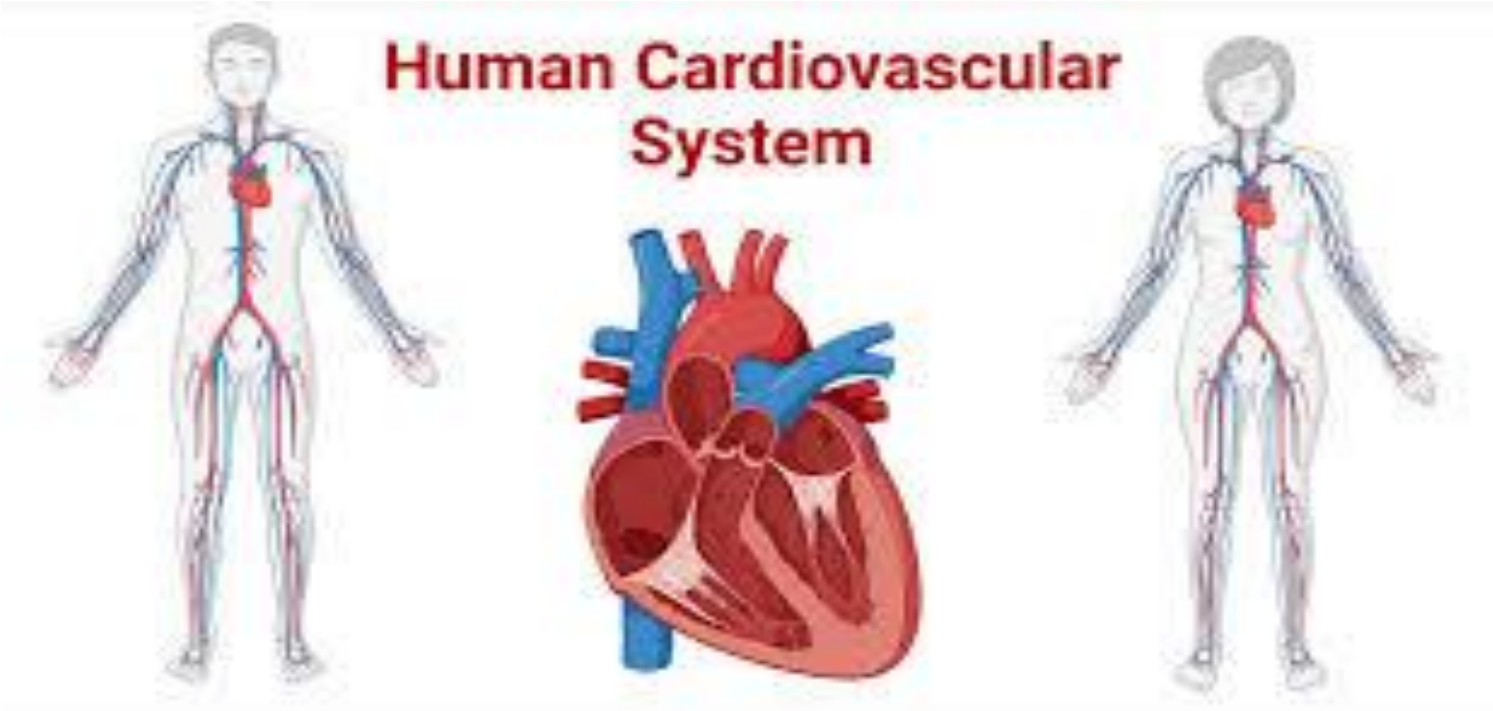
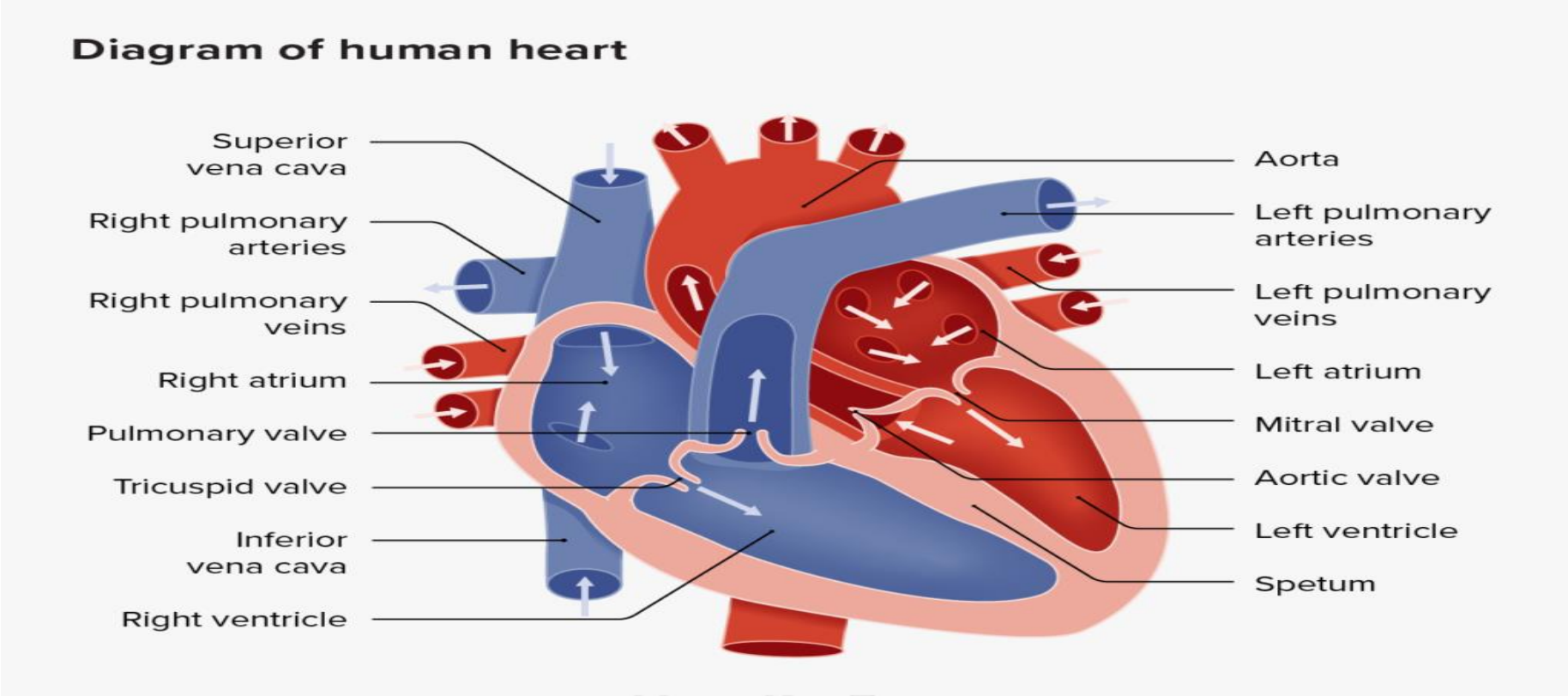
Introduction

The cardiovascular system is a marvel of biological engineering, responsible for the circulation of blood throughout the body, delivering oxygen and nutrients while removing metabolic waste products.

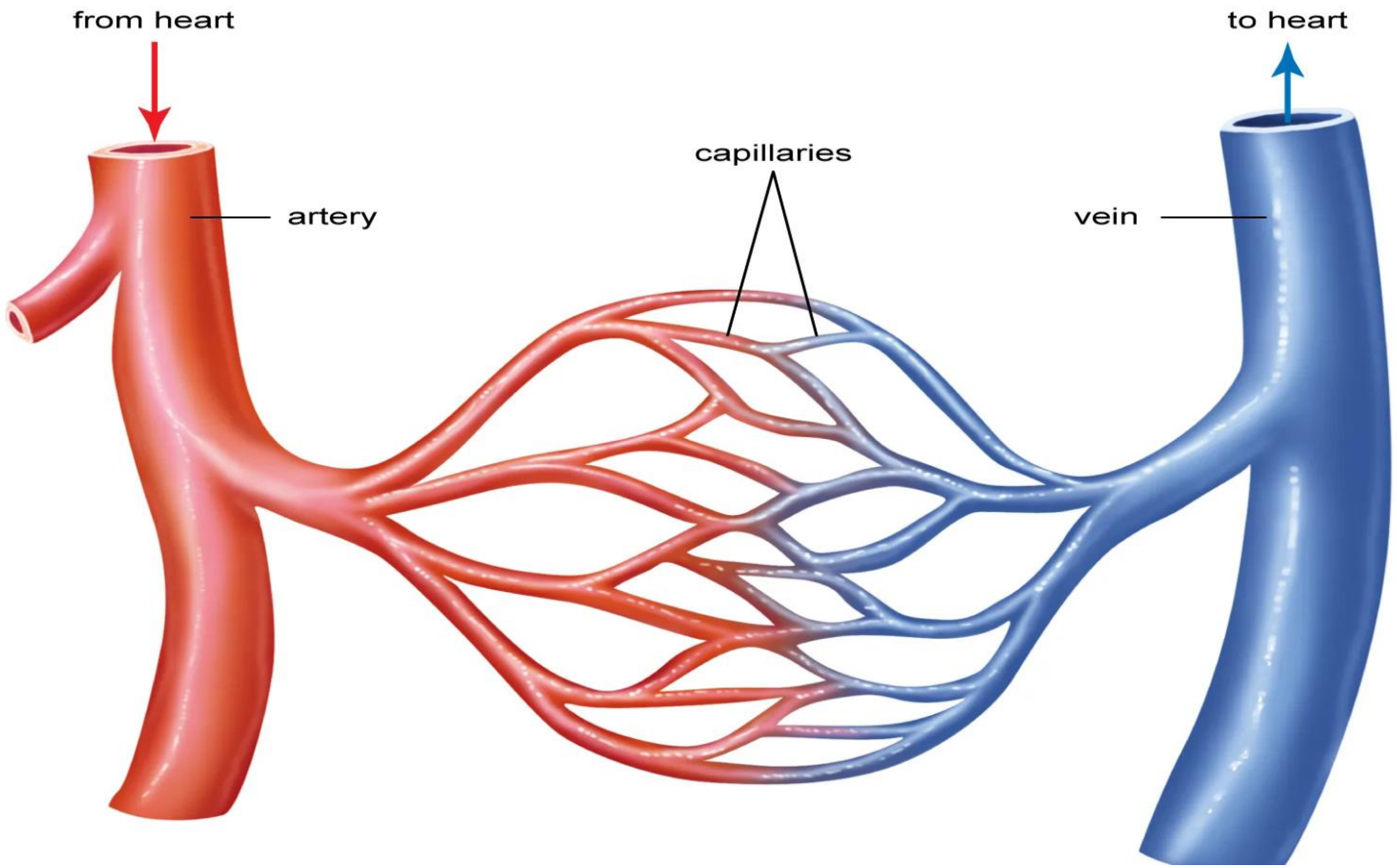


The components of the cardiovascular system:

1. The Heart: The heart is the central organ of the cardiovascular system, responsible for pumping blood throughout the body. It consists of four chambers: two atria and two ventricles. The right side of the heart pumps blood to the lungs for oxygenation, while the left side pumps oxygen-rich blood to the rest of the body.

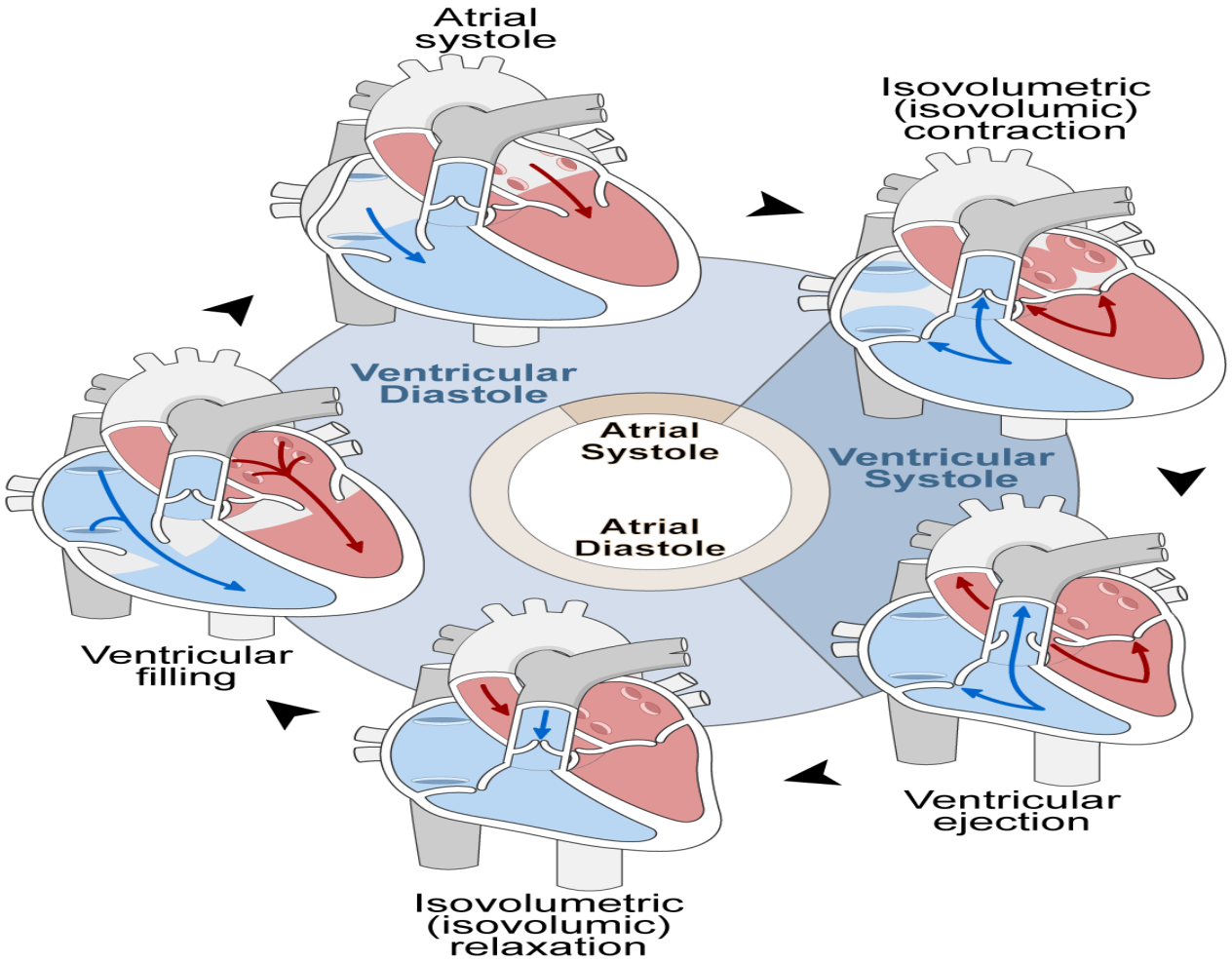


2. Blood Vessels: Blood vessels form a vast network throughout the body, including arteries, veins, and capillaries. Arteries carry oxygen-rich blood away from the heart, while veins return oxygen-depleted blood back to the heart. Capillaries are tiny blood vessels where exchange of nutrients, oxygen, and waste products occurs between the blood and surrounding tissues.

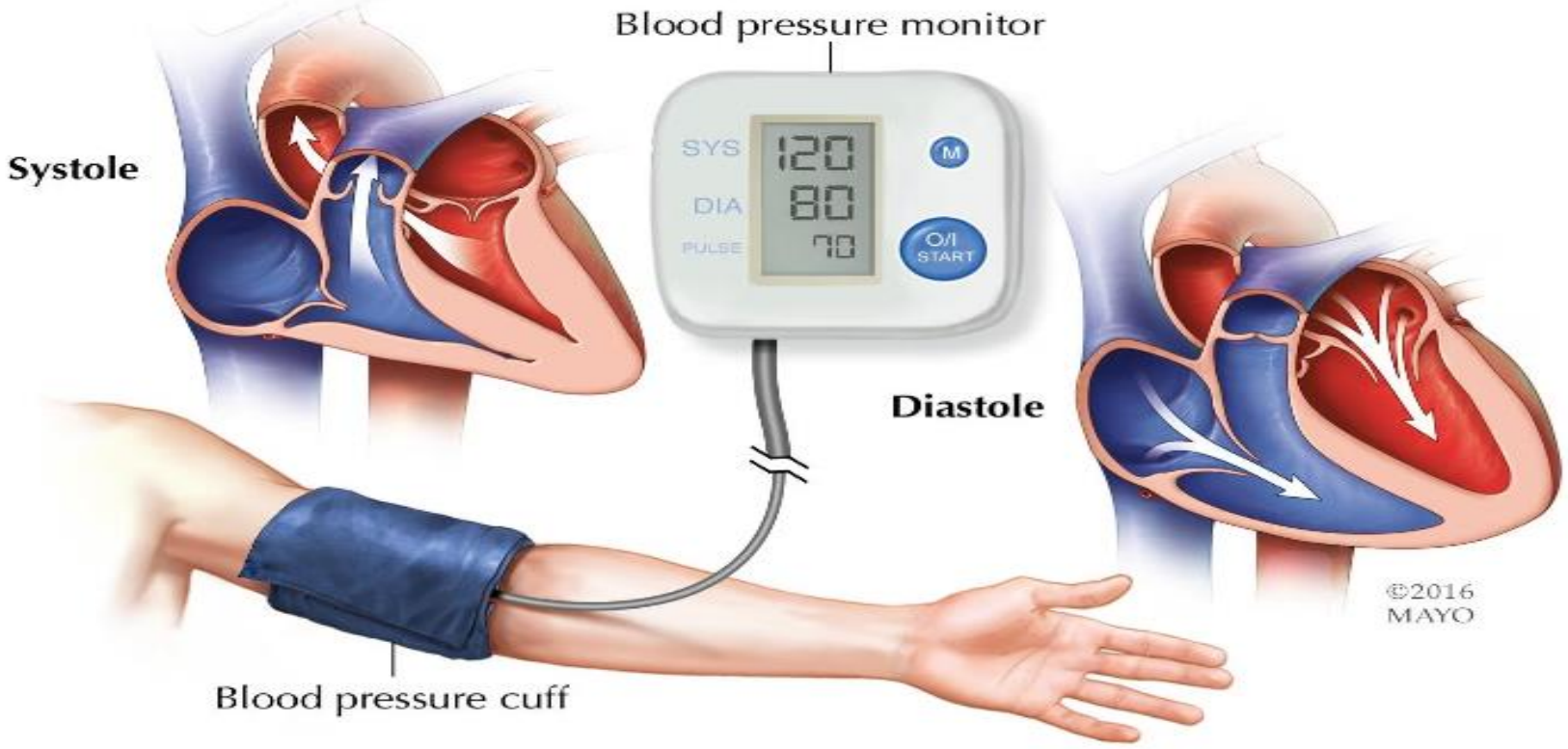


the dynamics of blood flow within the cardiovascular system:

1. **Cardiac Cycle**: The cardiac cycle refers to the sequence of events that occur during one heartbeat. It consists of two main phases: diastole and systole. During diastole, the heart relaxes and fills with blood. This is followed by systole, where the heart contracts, pumping blood into the arteries.



2. **Blood Pressure**: Blood pressure is the force exerted by the blood against the walls of the blood vessels. It is measured in millimeters of mercury (mmHg) and consists of two values: systolic pressure (the pressure during heart contraction) and diastolic pressure (the pressure during heart relaxation). Normal blood pressure is typically around 120/80 mmHg.



3. **Regulation of Blood Flow**: Blood flow is regulated by various mechanisms to ensure adequate perfusion of tissues. This includes neural regulation (such as the autonomic nervous system), hormonal regulation (such as adrenaline and noradrenaline), and local factors (such as metabolic demands and tissue oxygenation).

4. **Peripheral Resistance**: Peripheral resistance refers to the resistance encountered by blood flow in the systemic circulation. It is influenced by factors such as the diameter of blood vessels, blood viscosity, and vessel length. Arterioles play a crucial role in regulating peripheral resistance by constricting or dilating in response to various stimuli.

5. **Capillary Exchange**: Capillaries are the site of exchange between the blood and surrounding tissues. This exchange occurs through processes such as diffusion, osmosis, and filtration. Nutrients, oxygen, and hormones diffuse from the blood into the tissues, while waste products and carbon dioxide diffuse from the tissues into the blood.