Chapter 22

The Cardiovascular System — Vessels and Circulation

PowerPoint® Lecture Slides
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The **cardiovascular system** is a closed system that circulates **blood**.

There are two groups of blood vessels:

- One supplies the lungs (the **pulmonary circuit**).
- The other supplies the rest of the body (the **systemic circuit**).

Blood is pumped from the heart into both the pulmonary and systemic (aortic) trunks simultaneously.
Histological Organization of Blood Vessels

- Blood vessel walls
  - *Tunica intima*
    - Inner layer
    - Endothelium and CT
  - *Tunica media*
    - Middle layer
    - Smooth muscle and CT
  - *Adventitia*
    - Outer layer
    - Mostly CT
Figure 22.1 Histological Comparison of Typical Arteries and Veins
Figure 22.2 Histological Structure of Blood Vessels
Types of arteries:

- **Elastic arteries**, or **conducting arteries**, are large vessels with diameters of up to 2.5 cm (1 in.).

- **Muscular arteries**, or **distribution arteries** (also known as medium-sized arteries), transport blood to the body’s skeletal muscle and internal organs.

- **Arterioles** are considerably smaller than muscular arteries.
  - Arterioles have an average diameter of about 30 μm.
Figure 22.3 A Plaque Blocking a Peripheral Artery
Histological Organization of Blood Vessels

- **Capillaries:**
  - Smallest and most delicate blood vessels
  - Their walls permit exchange between the blood and the surrounding interstitial fluids
- **Types of capillaries:**
  - Continuous—has a complete endothelial lining
  - Fenestrated—contains “windows” in their walls due to perforated endothelial lining
  - Sinusoids—specialized fenestrated capillaries found in selected tissues (such as the liver) that allow very slow blood flow
Figure 22.4 Structure of Capillaries
Figure 22.5 Organization of a Capillary Bed
Types of veins:

- **Venules**, the smallest veins, collect blood from capillaries.
  - An average venule has a diameter of roughly 20 μm.
- **Medium-sized veins** range from 2 to 9 mm in internal diameter and correspond in general size to medium-sized arteries.
- **Large veins** include the great veins, the *superior and inferior venae cavae*, and their tributaries within the abdominopelvic and thoracic cavities.
Figure 22.6 Function of Valves in the Venous System
Figure 22.7 The Distribution of Blood in the Cardiovascular System
Blood Vessel Distribution

- Distribution of arteries and veins on the left and right sides is usually identical except near the heart.
- A single vessel may have several different names as it crosses specific anatomical boundaries, making accurate anatomical descriptions possible.
- Arteries and veins often make anastomotic connections that reduce the impact of blockage of a single vessel.
Figure 22.8 An Overview of the General Pattern of Circulation
Blood Vessel Distribution

- **Pulmonary circuit**
  - Carries deoxygenated blood to the lungs then back to the heart
  - Includes the pulmonary trunk, the left and right pulmonary arteries, and the pulmonary veins

- **Systemic circuit**
  - Carries oxygenated blood to the body tissues
  - Includes the **coronary circuit**, which supplies the myocardium
Figure 22.9a The Pulmonary Circuit: (a) Anatomy of the Pulmonary Circuit
Figure 22.9b The Pulmonary Circuit: (b) Coronary Angiogram
Figure 22.10 An Overview of the Systemic Arterial System
Figure 22.11 Aortic Angiogram
Figure 22.12a Arteries of the Chest and Upper Limb: (a) Arteries of the Chest and Upper Limb
Figure 22.12b Arteries of the Chest and Upper Limb: (b) Right Forearm, Anterior View
Figure 22.12c Arteries of the Chest and Upper Limb: (c) Right Axillary Region, Anterior View
Figure 22.12d Arteries of the Chest and Upper Limb: (d) Summary of Arterial Distribution from Aortic Arch
Figure 22.13a Arteries of the Neck and Head: (a) Arteries of Neck and Head, an Oblique Lateral View from the Right Side
Figure 22.13b Arteries of the Neck and Head: (b) Angiogram, Lateral Projection
Figure 22.14 Major Arteries of the Neck
Figure 22.15a The Arterial Supply to the Brain: (a) Arteries of the Brain, Inferior View
Figure 22.15b The Arterial Supply to the Brain: (b) Arteries Injected to Show Cerebral Arterial Circle
Figure 22.15c The Arterial Supply to the Brain: (c) Corrosion Cast of Cerebral Arteries, Left Cerebral Hemisphere
Figure 22.16 Major Arteries of the Trunk
Figure 22.17a Arteries of the Abdomen: (a) Arteries Supplying the Abdominal Organs (Anterior View)
Figure 22.17b Arteries of the Abdomen: (b) Angiogram of the Abdominal Aorta
Figure 22.18a Major Arteries of the Lower Limb, Part I: (a) Anterior View
Figure 22.18b Major Arteries of the Lower Limb, Part I: (b) Femoral Vessels
Figure 22.19a Major Arteries of the Lower Limb, Part II: (a) Posterior View
Figure 22.19b Major Arteries of the Lower Limb, Part II: (b) Major Arteries of the Lower Limb

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Figure 22.20 A Summary of the Arterial System
Figure 22.29 Radiograph of Tony’s Left Subclavian Artery Showing Decreased Diameter
Blood Vessel Distribution

Figure 22.21 An Overview of the Systemic Venous System
Blood Vessel Distribution

Figure 22.22a Major Veins of the Head and Neck: (a) Veins of the Head and Neck, Lateral View

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Figure 22.22b Major Veins of the Head and Neck: (b) Venous Drainage of the Brain, Inferior View
Figure 22.23 The Venous Drainage of the Trunk and Upper Limb
Blood Vessel Distribution

Figure 22.24a A Summary Flowchart of the Venous System: (a) Tributaries of the Superior Vena Cava
Figure 22.24b A Summary Flowchart of the Venous System: (b) Tributaries of the Inferior Vena Cava
Blood Vessel Distribution

Figure 22.24c A Summary Flowchart of the Venous System: (c) Summary of the Veins of the Lower Limb
Figure 22.25a The Venous Drainage of the Lower Limb: (a) Anterior View
Figure 22.25b The Venous Drainage of the Lower Limb: (b) Posterior View
Figure 22.26 The Hepatic Portal System
Cardiovascular Changes at Birth

- Changes are made to adapt to extra-uterine life
  - Blood shunts close
  - Blood begins to be pumped to the lungs
  - Newborn oxygenates blood for the first time
Cardiovascular Changes at Birth

Figure 22.27a Changes in Fetal Circulation at Birth: (a) Full-term fetus (Before Birth)
Cardiovascular Changes at Birth

Figure 22.27b Changes in Fetal Circulation at Birth: (b) After Delivery
Cardiovascular Changes at Birth

Figure 22.27c Changes in Fetal Circulation at Birth: (c) Fetal Circulatory Pattern
Cardiovascular Changes at Birth

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<thead>
<tr>
<th>(a) Patent foramen ovale and ductus arteriosus</th>
<th>(b) Ventricular septal defect</th>
<th>(c) Tetralogy of Fallot</th>
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<tbody>
<tr>
<td>Patent ductus arteriosus</td>
<td>Ventricular septal defect</td>
<td>Pulmonary stenosis</td>
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<tr>
<th>(d) Transposition of great vessels</th>
<th>(e) Atrioventricular septal defect</th>
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<tr>
<td>Aorta</td>
<td>Pulmonary trunk</td>
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<tr>
<td>Patent ductus arteriosus</td>
<td>Ventricular defect</td>
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</tbody>
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Figure 22.28 Congenital Cardiovascular Problems
Aging and the Cardiovascular System

- Changes occur in the blood, heart, and blood vessels.
  - **Blood changes**
    - Decreased HCT
    - Thrombi and emboli form more easily
    - Blood pools in legs
  - **Heart changes**
    - Reduced efficiency and elasticity
    - Atherosclerosis of coronary vessels
    - Scar tissue forms
  - **Blood vessel changes**
    - Loss of elasticity
    - Calcium deposits damage vessel walls