PART A

The Cardiovascular System Day One!

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ESSENTIALS OF HUMAN ANATOMY & PHYSIOLOGY
EIGHTH EDITION

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The Cardiovascular System

- A closed system of the heart and blood vessels
  - The heart pumps blood
  - Blood vessels allow blood to circulate to all parts of the body
- The function of the cardiovascular system is to deliver oxygen and nutrients and to remove carbon dioxide and other waste products
The Heart

- Location
  - Thorax between the lungs
  - Pointed apex directed toward left hip
  - About the size of your fist
The Heart: Coverings

- Pericardium – a double serous membrane
  - Visceral pericardium (Next to heart/part of heart wall)
  - Parietal pericardium (Outside layer)
- Serous fluid fills the space between the layers of pericardium (reduces friction)
The Heart: Heart Wall

- Three layers
  - Epicardium
    - Outside layer
    - This layer is the visceral pericardium
    - Connective tissue layer
  - Myocardium
    - Middle layer
    - Mostly cardiac muscle
  - Endocardium
    - Inner layer
    - Endothelium
External Heart Anatomy

Brachiocephalic artery
Superior vena cava
Right pulmonary artery
Ascending aorta
Pulmonary trunk
Right pulmonary veins

Right atrium
Right coronary artery in coronary sulcus (right atrioventricular groove)
Anterior cardiac vein

Right ventricle
Marginal artery
Small cardiac vein
Inferior vena cava

Left atrium
Auricle
Circumflex artery
Left coronary artery in coronary sulcus (left atrioventricular groove)

Left ventricle
Great cardiac vein
Anterior interventricular artery

Figure 11.2a
The Heart: Chambers

- Right and left sides act as separate pumps

- Four chambers
  - Atria
    - Receiving chambers
      - Right atrium
      - Left atrium
  - Ventricles
    - Discharging chambers
      - Right ventricle
      - Left ventricle

Figure 11.2c
Blood Circulation

Figure 11.3

KEY:
- Red = Oxygen rich, CO₂-poor blood
- Blue = Oxygen poor, CO₂-rich blood

Capillary beds of all body tissues where gas exchange occurs

Pulmonary Circuit
- Pulmonary arteries
- Pulmonary veins
- Aorta and branches

Systemic Circuit
- Venae cavae
- Right atrium
- Left atrium
- Right ventricle
- Left ventricle
The Heart: Valves

- Allow blood to flow in only one direction

- Four valves
  - Atrioventricular (AV) valves – between atria and ventricles
    - Bicuspid/mitral valve (left)
    - Tricuspid valve (right)
  - Semilunar valves between ventricle and artery leaving heart
    - Pulmonary semilunar valve
    - Aortic semilunar valve
The Heart: Valves

- Valves open as blood is pumped through
- Held in place by chordae tendineae (“heart strings”)
- Close to prevent backflow
**Operation of Heart Valves**

**Operation of the AV valves**

1. Blood returning to the atria, puts pressure against AV valves; the AV valves are forced open
2. As the ventricles fill, AV valve flaps hang limply into ventricles
3. Atria contract, forcing additional blood into ventricles

**Operation of the semilunar valves**

1. Ventricles contract, forcing blood against AV valve flaps
2. AV valves close
3. Chordae tendineae tighten, preventing valve flaps from evertting into atria

As ventricles contract and intraventricular pressure rises, blood is pushed up against semilunar valves, forcing them open

As ventricles relax, and intraventricular pressure falls, blood flows back from arteries, filling the leaflets of semilunar valves and forcing them to close

Figure 11.4

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The Heart: Associated Great Vessels

- Aorta (artery)
  - Leaves left ventricle (heads out to body)
- Pulmonary arteries
  - Leave right ventricle (heads out to lungs)
- Vena cava (veins)
  - Enters right atrium (coming back from body)
- Pulmonary veins (four)
  - Enter left atrium (coming back from lungs)
Coronary Circulation

- Blood in the heart chambers does not nourish the myocardium
- The heart has its own nourishing circulatory system
  - Coronary arteries
  - Cardiac veins
  - Blood empties into the right atrium via the coronary sinus