

chapter

**1**

# Structure and Function of Body Systems

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# Cardiovascular System

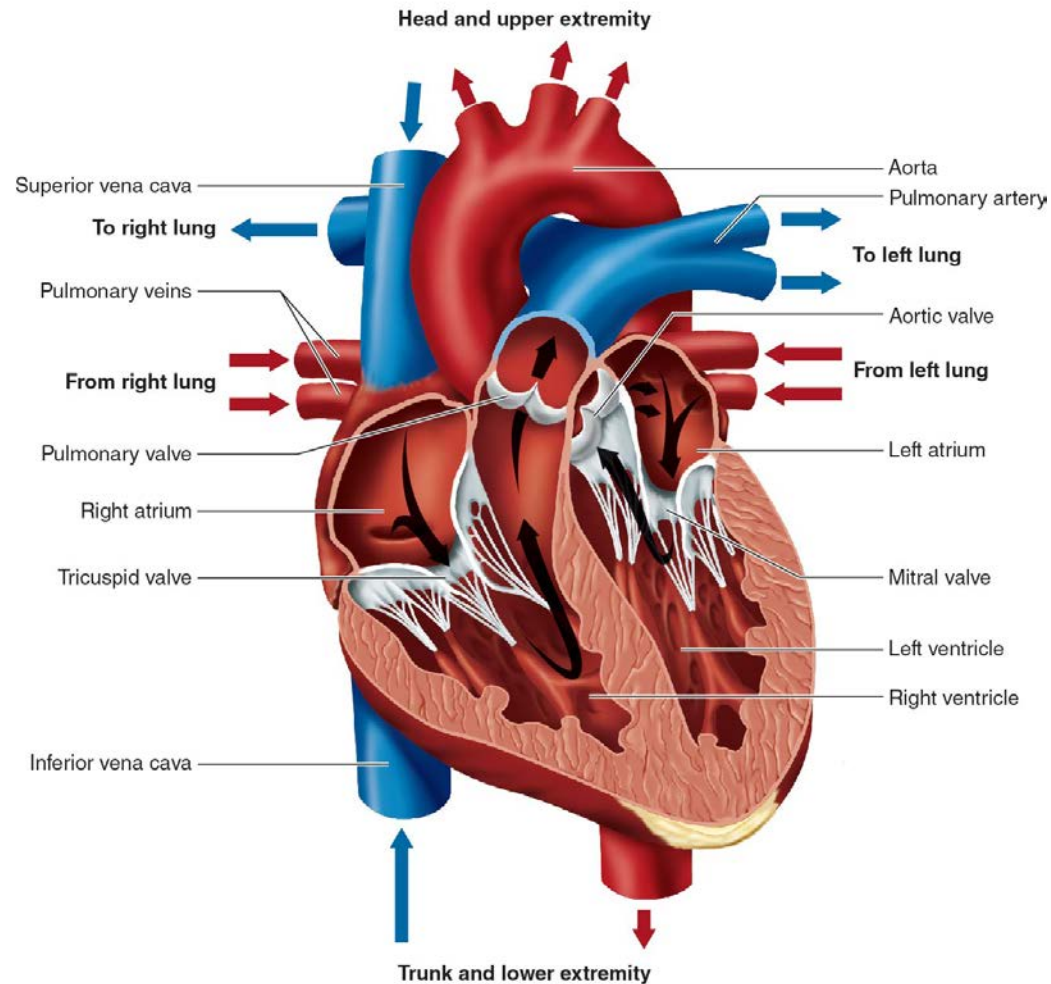
- **Heart**

- The heart is a muscular organ made up of two interconnected but separate pumps.
  - The right ventricle pumps blood to the lungs.
  - The left ventricle pumps blood to the rest of the body.

# Heart and Blood Flow

- **Figure 1.11 (next slide)**
  - Structure of the human heart and course of blood flow through its chambers

# Figure 1.11



# Cardiovascular System

- **Heart**
  - Valves
    - Tricuspid valve and mitral (bicuspid) valve
    - Aortic valve and pulmonary valve
    - Valves open and close passively, depending on the pressure gradient
  - Conduction system
    - Controls the mechanical contraction of the heart

# Cardiac Conduction

- **Rhythmicity and conduction properties of myocardium**
  - Influenced by cardiovascular center of medulla
  - Signals transmitted through sympathetic and parasympathetic nervous systems
  - Bradycardia (<60 beats/min)
  - Tachycardia (>100 beats/min)

# Cardiovascular System

- **Blood vessels**

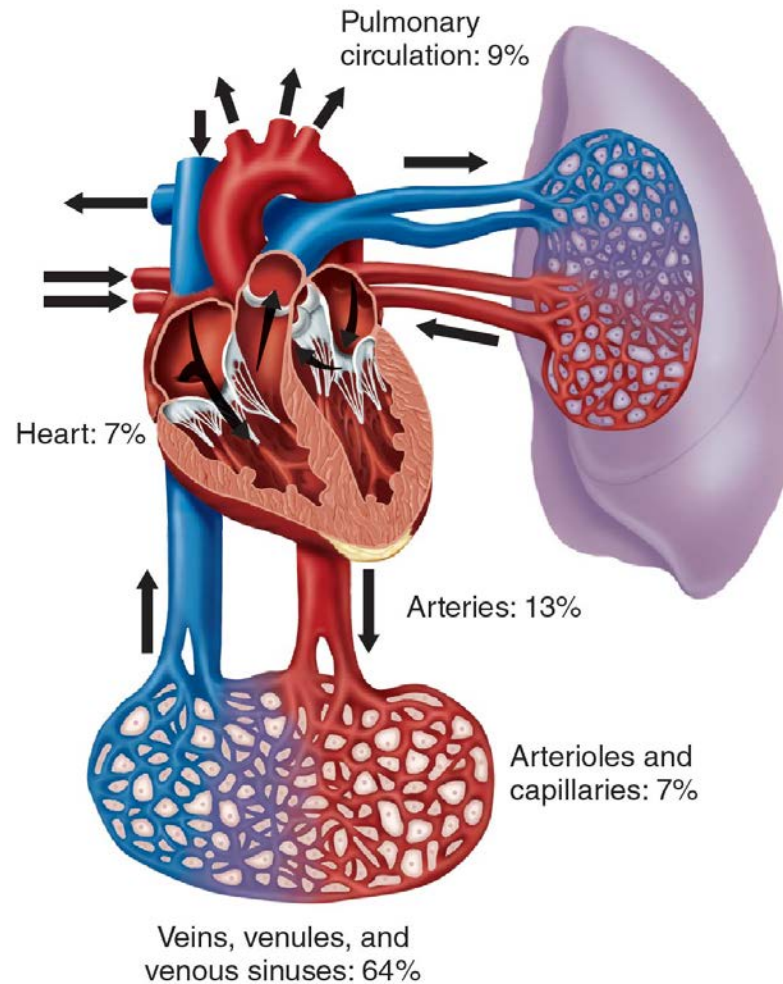
- Blood vessels operate in a closed-circuit system.
- The arterial system carries blood away from the heart.
- The venous system returns blood toward the heart.

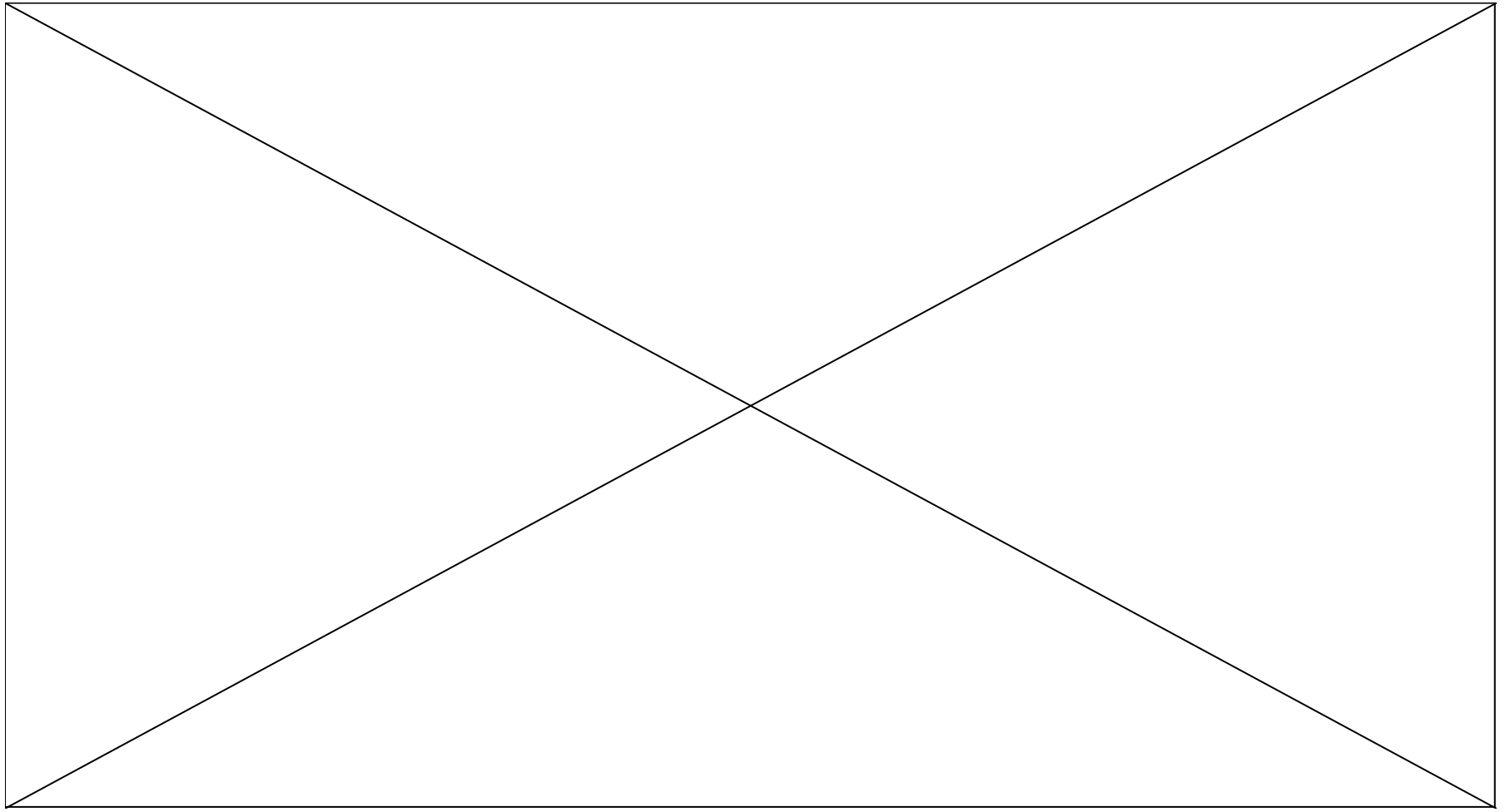
# Distribution of Blood

- **Figure 1.14 (next slide)**
  - The slide shows the arterial (right) and venous (left) components of the circulatory system.
  - The percent values indicate the distribution of blood volume throughout the circulatory system at rest.

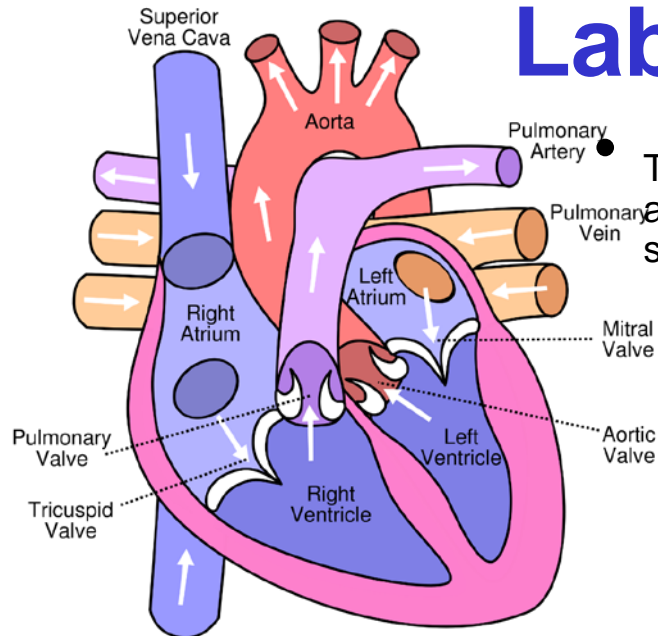


# Figure 1.14





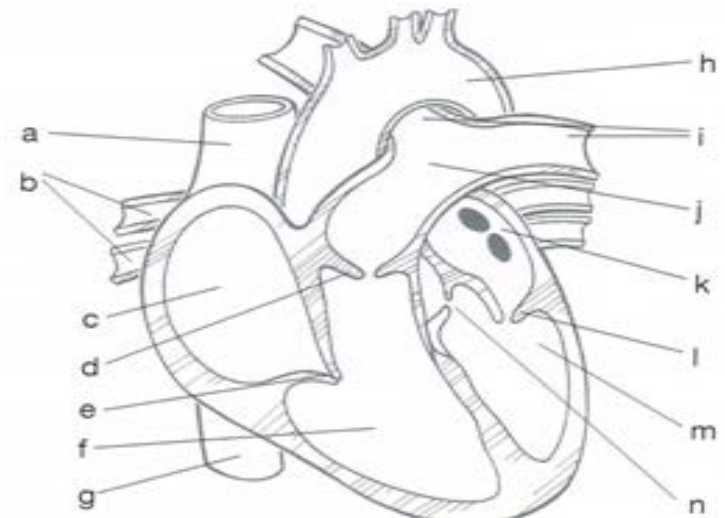
# Label the Heart



The heart is a muscle, and it responds much the same as any other muscle when worked, it will get bigger and stronger!

A-  
B-  
C-  
D-  
E-  
F-  
G-

H-  
I-  
J-  
K-  
L-  
M-  
N-



# Size

- **The adult heart is about the size of a closed fist and sits in the thorax on the left side of the chest in front of the lungs.**
- **This cardiovascular system is designed to transport oxygen and nutrients to the cells of the body and remove carbon dioxide and metabolic waste products from the body.**

# **The chambers of the heart include the:**

- **right atrium which receives deoxygenated blood (low in oxygen) from all over the body**
- **right ventricle receives blood from the right atrium and sends it to the lungs via the pulmonary artery to become oxygenated and get rid of carbon dioxide**
- **left atrium receives oxygenated blood from the lungs and sends it to the left ventricle**
- **left ventricle receives blood from the left atrium and sends it out to the body via the aorta.**


- **The left ventricle is generally about twice as thick as the right ventricle because it needs to generate enough force to push blood through the entire body while the right ventricle only needs to generate enough force to push blood through the lungs**

- **The major vessels that carry blood to and from the heart are:**
  - **inferior vena cava** conveys deoxygenated blood (blood low in oxygen) from the lower extremities of the body to the heart
  - **superior vena cava** conveys deoxygenated blood from the upper extremities of the body to the heart
  - **aorta** conveys oxygenated blood (blood high in oxygen) away from the heart

## 4 valves

- The *tricuspid valve* is between the right atrium and right ventricles.
- The *pulmonary valve* is between the right ventricle and the pulmonary artery.
- The *mitral valve* is between the left atrium and the left ventricle
- The *aortic valve* is between the left ventricle and the aorta.
  - The valves, under normal conditions, insure that blood only flows in one direction in the heart.



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- **During heavy exercise the demand may increase 15-25x greater than at rest**
  - **The primary purpose....**
    - Deliver adequate amounts of oxygen and remove wastes from body tissue.
    - Important to note that the respiratory system and circulatory system function together as a coupled unit

- Each pump or beat of the heart consists of two parts or phases - diastole and systole.
- During *diastole* the ventricles are filling and the atria contract. Then during *systole*, the ventricles contract while the atria are relaxed and filling.

# Blood Pressure

- **Blood pressure is the amount of force exerted against the walls of an artery by the blood. The heart muscle contracts and relaxes. The period of contraction is called systole and the period of relaxation is called diastole.**
- **The normal blood pressure range for an adult is .....**

# The purpose

- **The purpose of the CV system is**
  - 1. to transport O<sub>2</sub> to tissues and removal of wastes
  - 2. the transport of nutrients to tissues
  - 3. the regulation of body temperature

# Cardiovascular System

- **Blood vessels**
  - Arteries
  - Capillaries
  - Veins

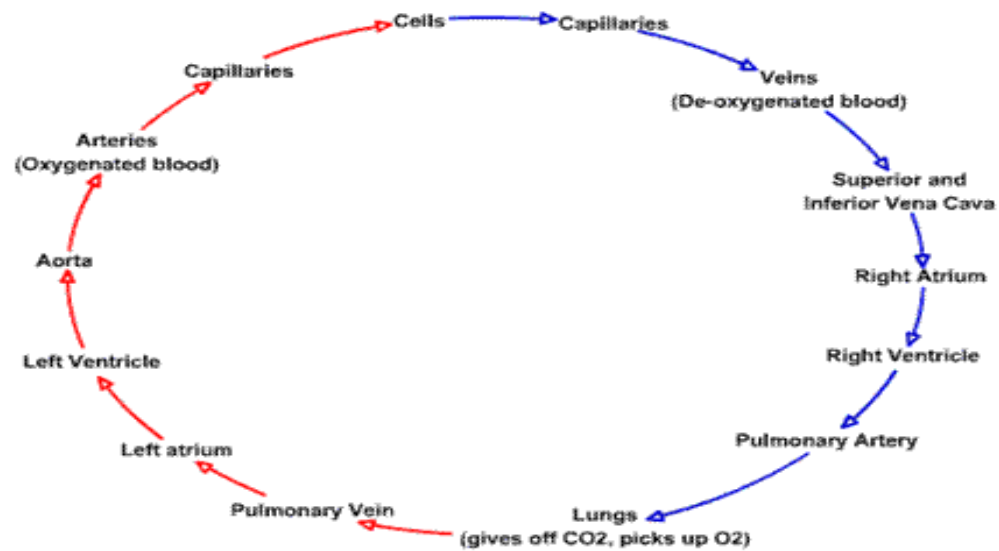
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# Arteries

- **Arteries are tubes that carry oxygenated blood (high in oxygen) away from the heart**
- **Arteries have thick, muscular, elastic walls. They branch off forming arterioles with thinner walls that then become capillaries. Arteries carry blood rich in oxygen and nutrients.**

# Veins

- **Veins are tubes that carry deoxygenated blood (low in oxygen) from the cells back to the heart where it is pumped to the lungs so that the blood can pick up more oxygen. The veins have one-way valves that help move the blood toward the heart.**





# Cardiovascular System *(continued)*

- **Blood**
  - Hemoglobin transports oxygen and serves as an acid–base buffer.
  - Red blood cells facilitate carbon dioxide removal.

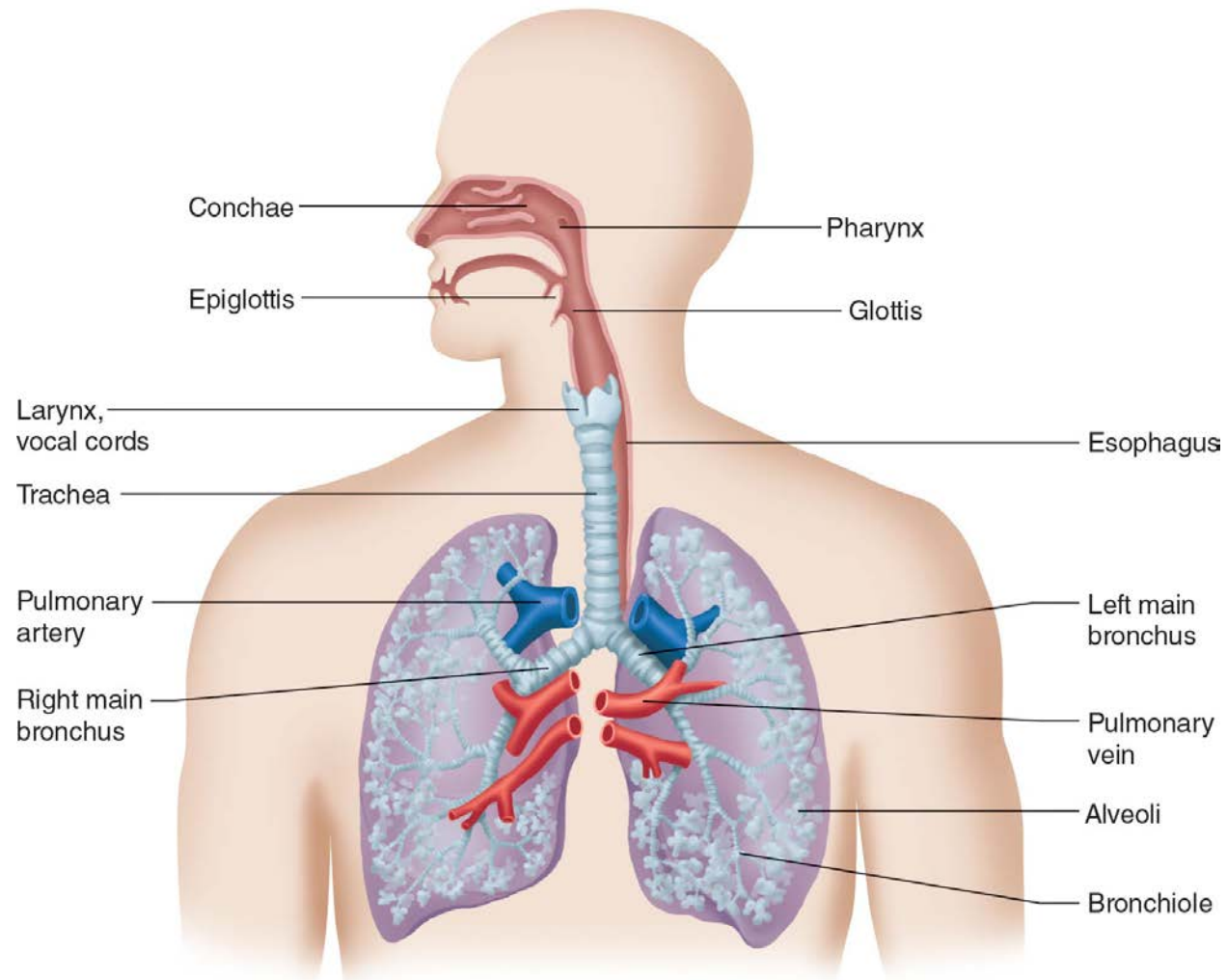
## Key Point

- **The cardiovascular system transports nutrients and removes waste products while helping to maintain the environment for all the body's functions. The blood transports oxygen from the lungs to the tissues for use in cellular metabolism; and it transports carbon dioxide from the tissues to the lungs, where it is removed from the body.**

# Respiratory System

- **Figure 1.15 (next slide)**
  - Gross anatomy of the human respiratory system

# Figure 1.15



# Respiratory System

- **Exchange of respiratory gases**
  - The primary function of the respiratory system is the basic exchange of oxygen and carbon dioxide.

*(continued)*

# Respiratory System *(continued)*

- **Exchange of air**
  - The amount and movement of air and expired gases in and out of the lungs are controlled by expansion and recoil of the lungs.

*(continued)*

# Respiratory System *(continued)*

- **Pleural pressure**
  - Pressure in the narrow space between the lung pleura and the chest wall pleura
    - Membranes enveloping the lungs and lining the chest walls

*(continued)*

# Respiratory System *(continued)*

- **Alveolar pressure**

- Pressure inside the alveoli when the glottis is open and no air is flowing into or out of the lungs
- To cause inward flow of air during inspiration, the pressure in the alveoli must fall to a value slightly below atmospheric pressure
- During expiration, alveolar pressure must rise above atmospheric pressure

*(continued)*



# Respiratory System *(continued)*

- **Diffusion:**
  - The process of diffusion is a simple random motion of molecules moving in opposite directions through the alveolar capillary membrane.