

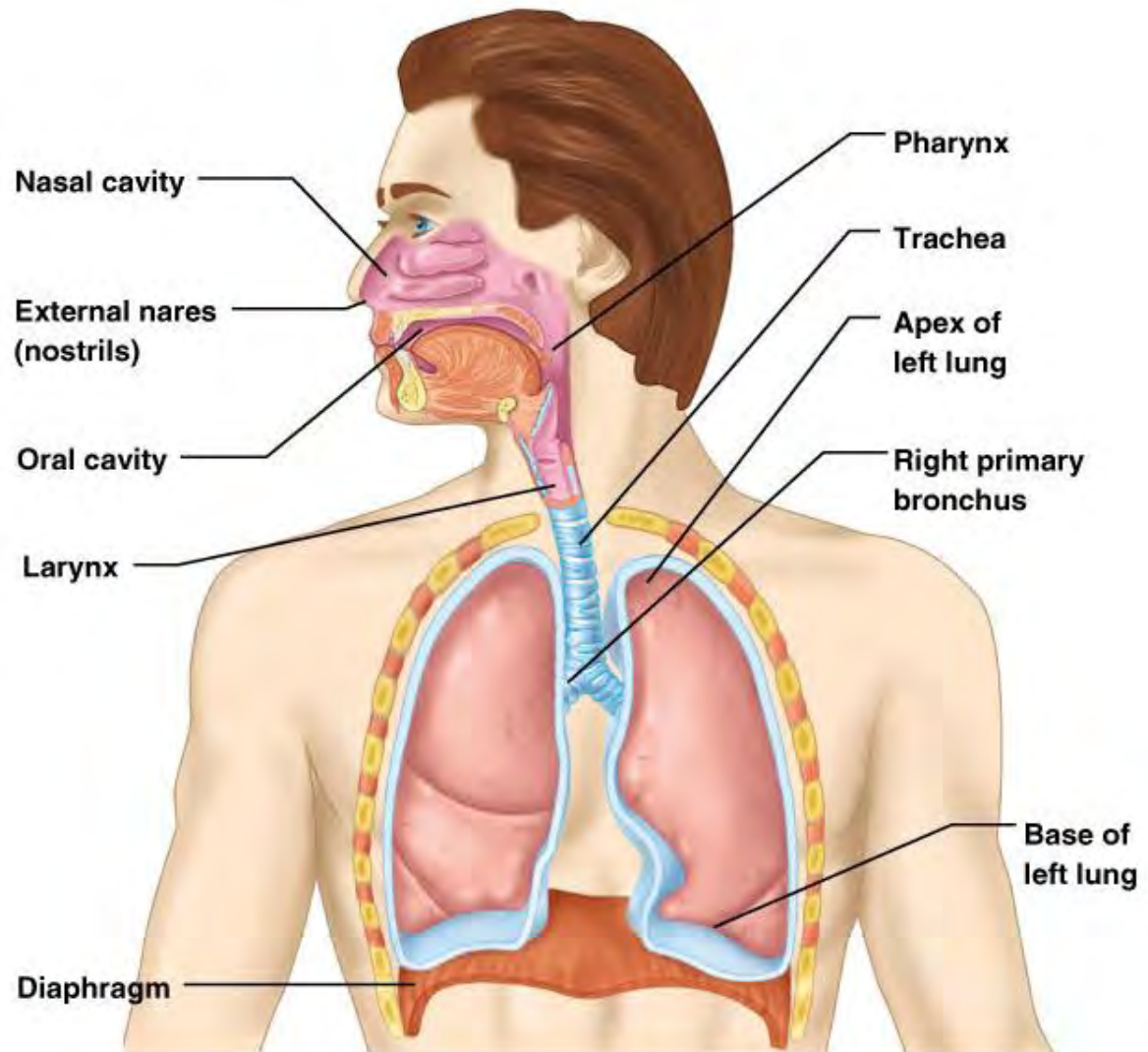
Care of Clients with Disorders of the Respiratory System A&P Review

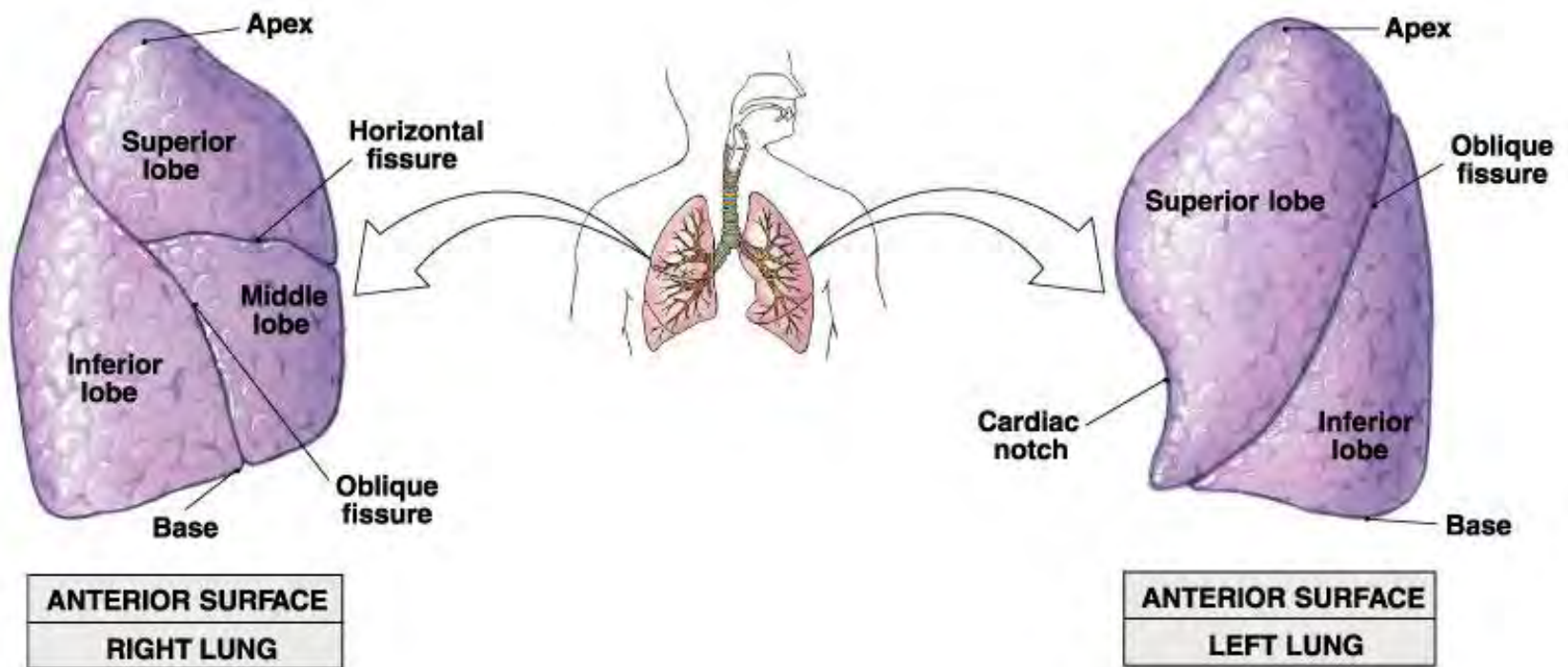
**NUR 142
Linda Mollino**

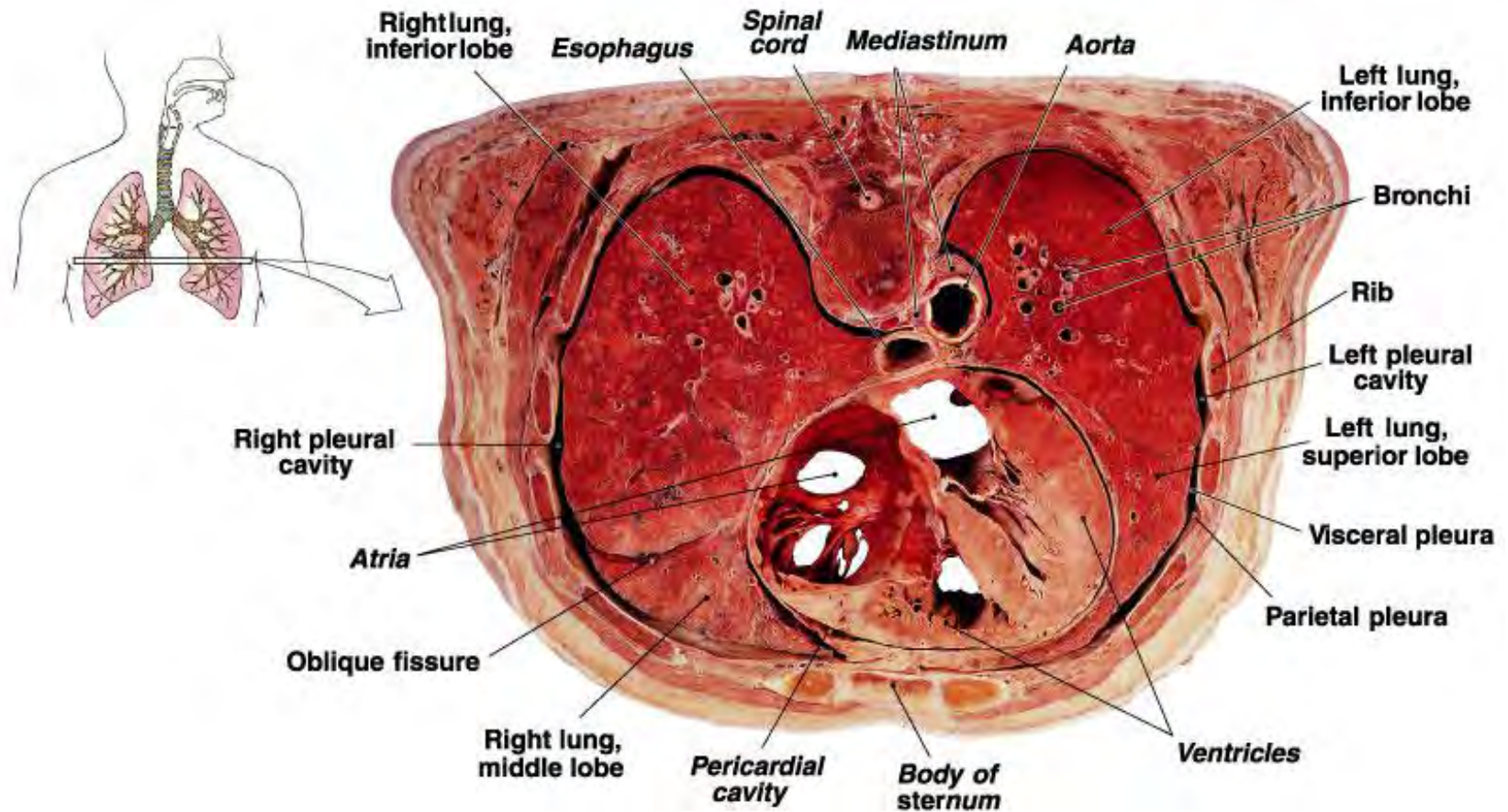


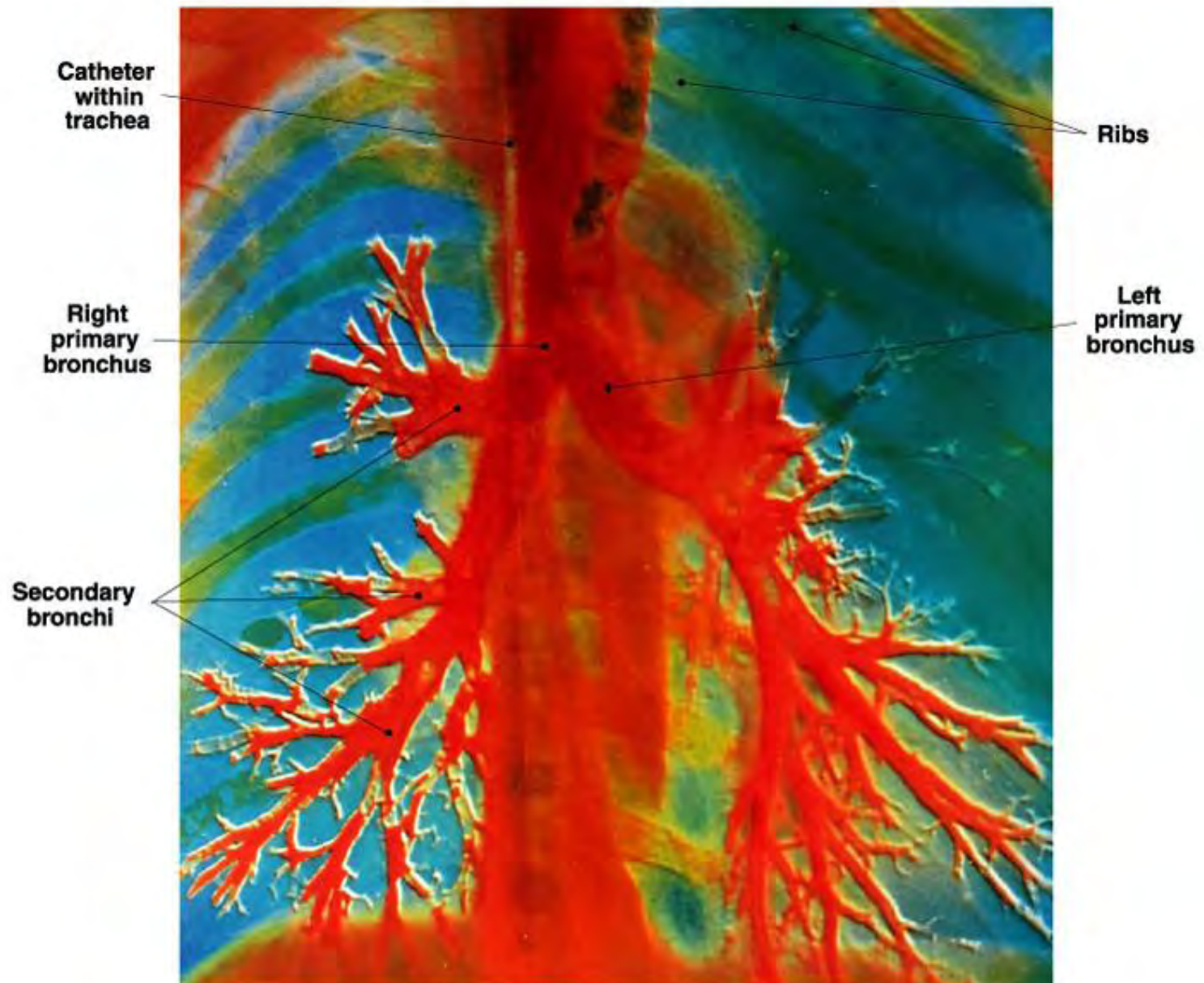
Organs of the Respiratory system

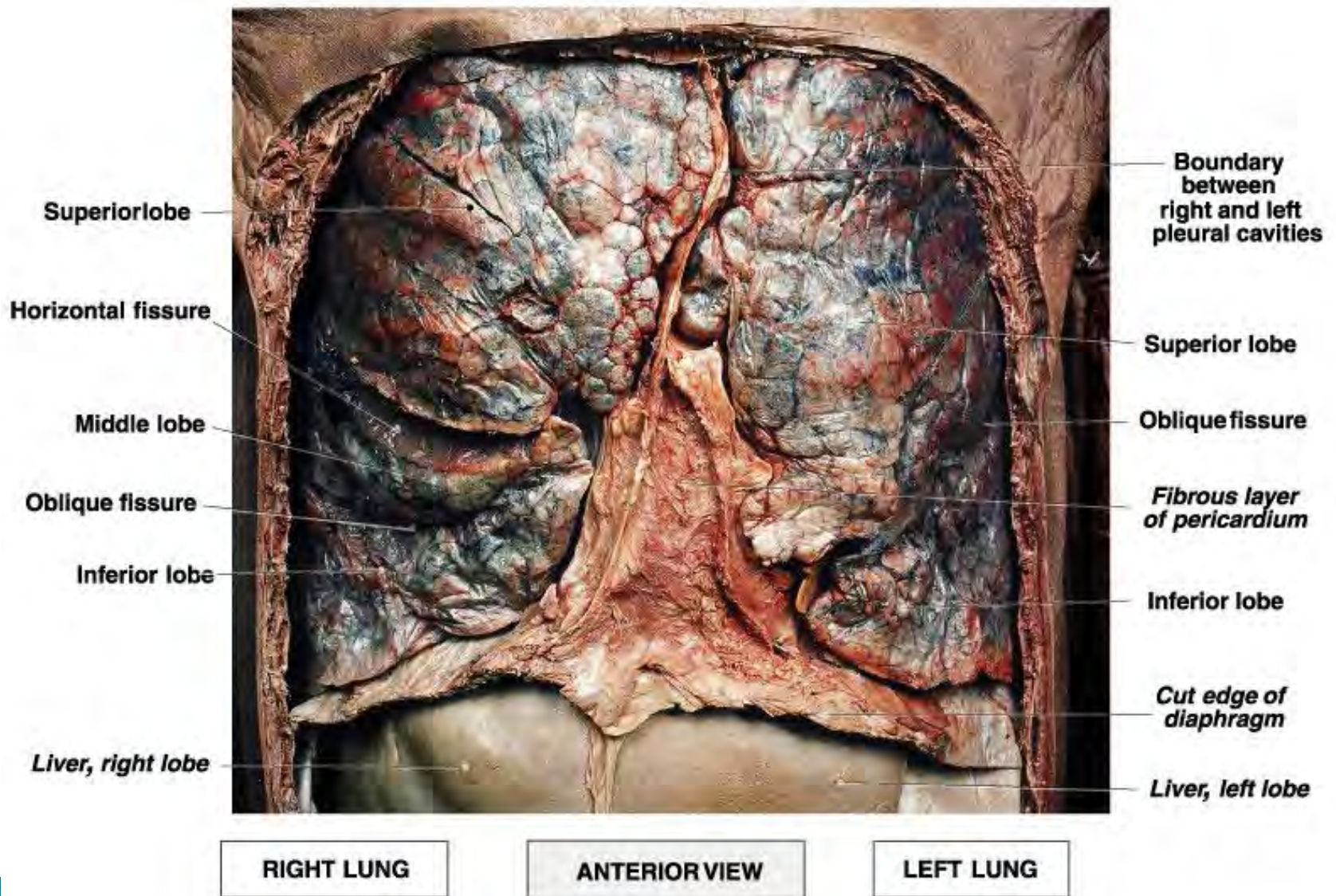
- Nose
- Pharynx
- Larynx
- Trachea
- Bronchi
- Lungs – alveoli











Function of the Respiratory System

- Oversees gas exchanges between the blood and external environment
- Exchange of gasses takes place within the lungs in the alveoli
- Passageways to the lungs purify, warm, and humidify the incoming air

Upper Respiratory Tract

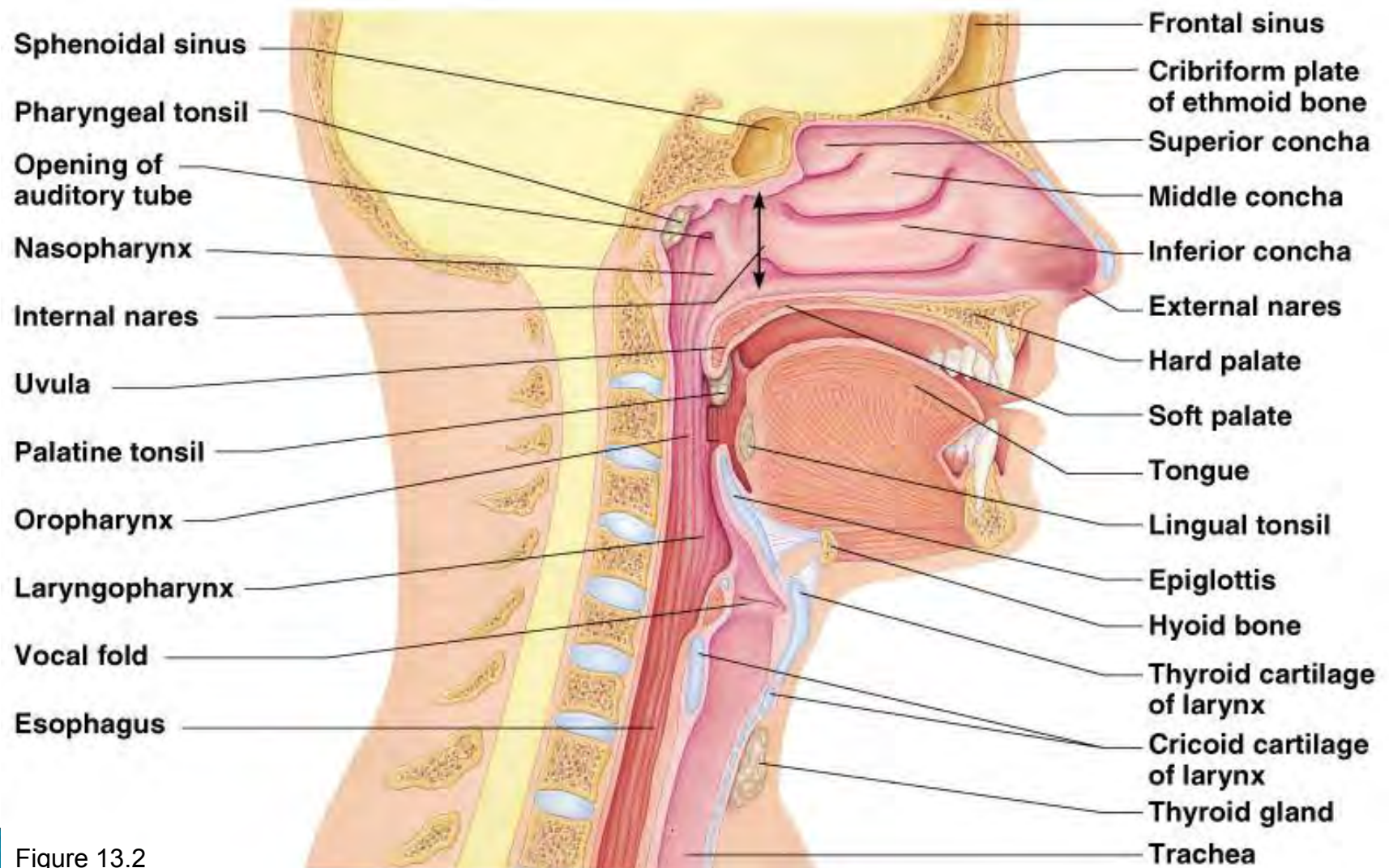


Figure 13.2

Anatomy of the Nasal Cavity

- Olfactory receptors are located in the mucosa on the superior surface
- The rest of the cavity is lined with respiratory mucosa
 - Moistens air
 - Traps incoming foreign particles

Pharynx (Throat)

- Muscular passage from nasal cavity to larynx
- Three regions of the pharynx
 - Nasopharynx – superior region behind nasal cavity
 - Oropharynx – middle region behind mouth
 - Laryngopharynx – inferior region attached to larynx
- The oropharynx and laryngopharynx are common passageways for air and food

Larynx (Voice Box)

- Routes air and food into proper channels
- Plays a role in speech
- Made of eight rigid hyaline cartilages and a spoon-shaped flap of elastic cartilage (epiglottis)

Structures of the Larynx

- **Thyroid cartilage**
 - **Largest hyaline cartilage**
 - **Protrudes anteriorly (Adam's apple)**
- **Epiglottis**
 - **Superior opening of the larynx**
 - **Routes food to the larynx and air toward the trachea**
 - **Vocal cords (vocal folds)**
 - **Vibrate with expelled air to create sound (speech)**
 - **Glottis – opening between vocal cords**

Trachea (Windpipe)

- Connects larynx with bronchi
- Lined with ciliated mucosa
 - Beat continuously in the opposite direction of incoming air
 - Expel mucus loaded with dust and other debris away from lungs
- Walls are reinforced with C-shaped hyaline cartilage

Primary Bronchi

- Formed by division of the trachea
- Enters the lung at the hilus (medial depression)
- Right bronchus is wider, shorter, and straighter than left
- Bronchi subdivide into smaller and smaller branches

Lungs

- Occupy most of the thoracic cavity
 - Apex is near the clavicle (superior portion)
 - Base rests on the diaphragm (inferior portion)
 - Each lung is divided into lobes by fissures
 - Left lung – two lobes
 - Right lung – three lobes

Lungs

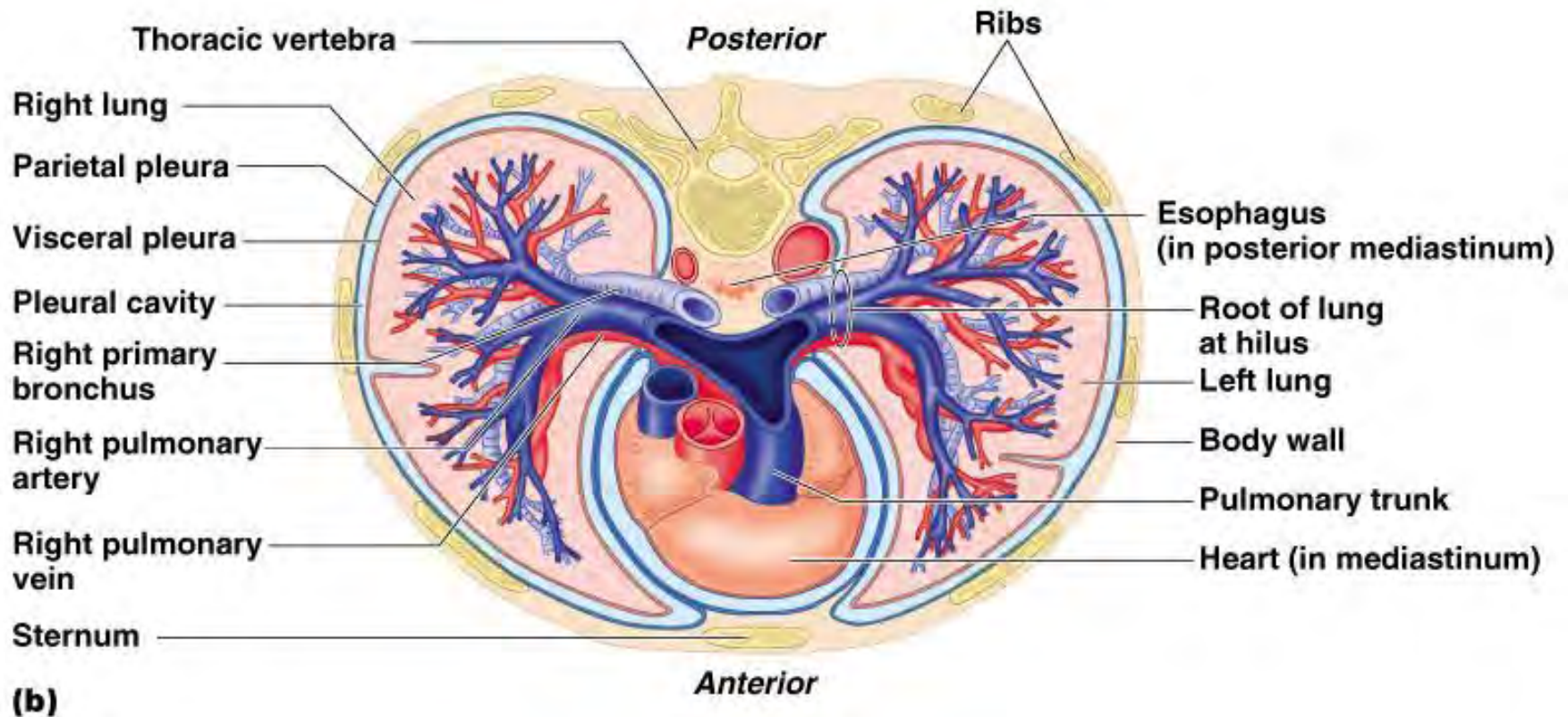
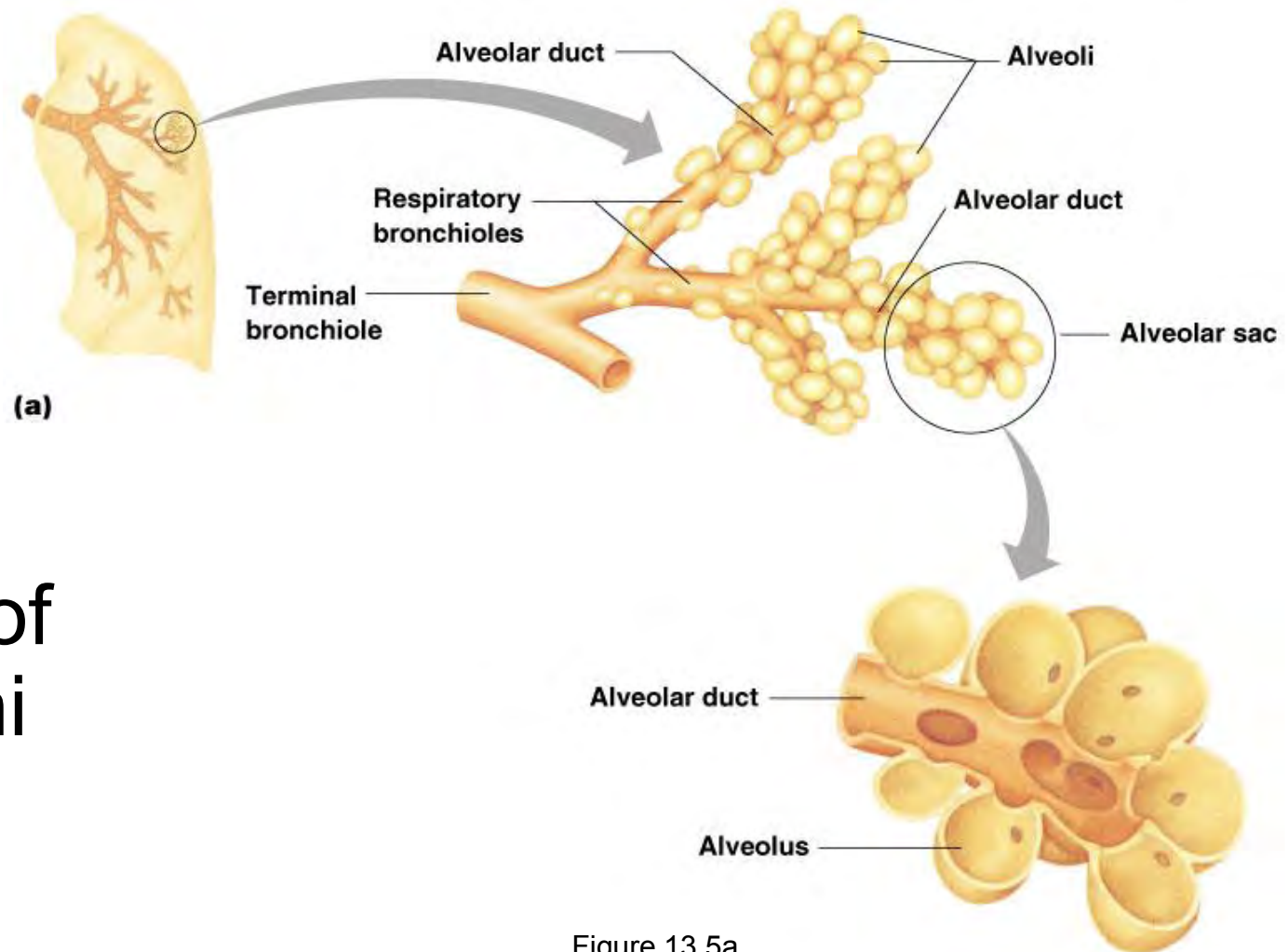


Figure 13.4b

Coverings of the Lungs

- Pulmonary (visceral) pleura covers the lung surface
- Parietal pleura lines the walls of the thoracic cavity
- Pleural fluid fills the area between layers of pleura to allow gliding

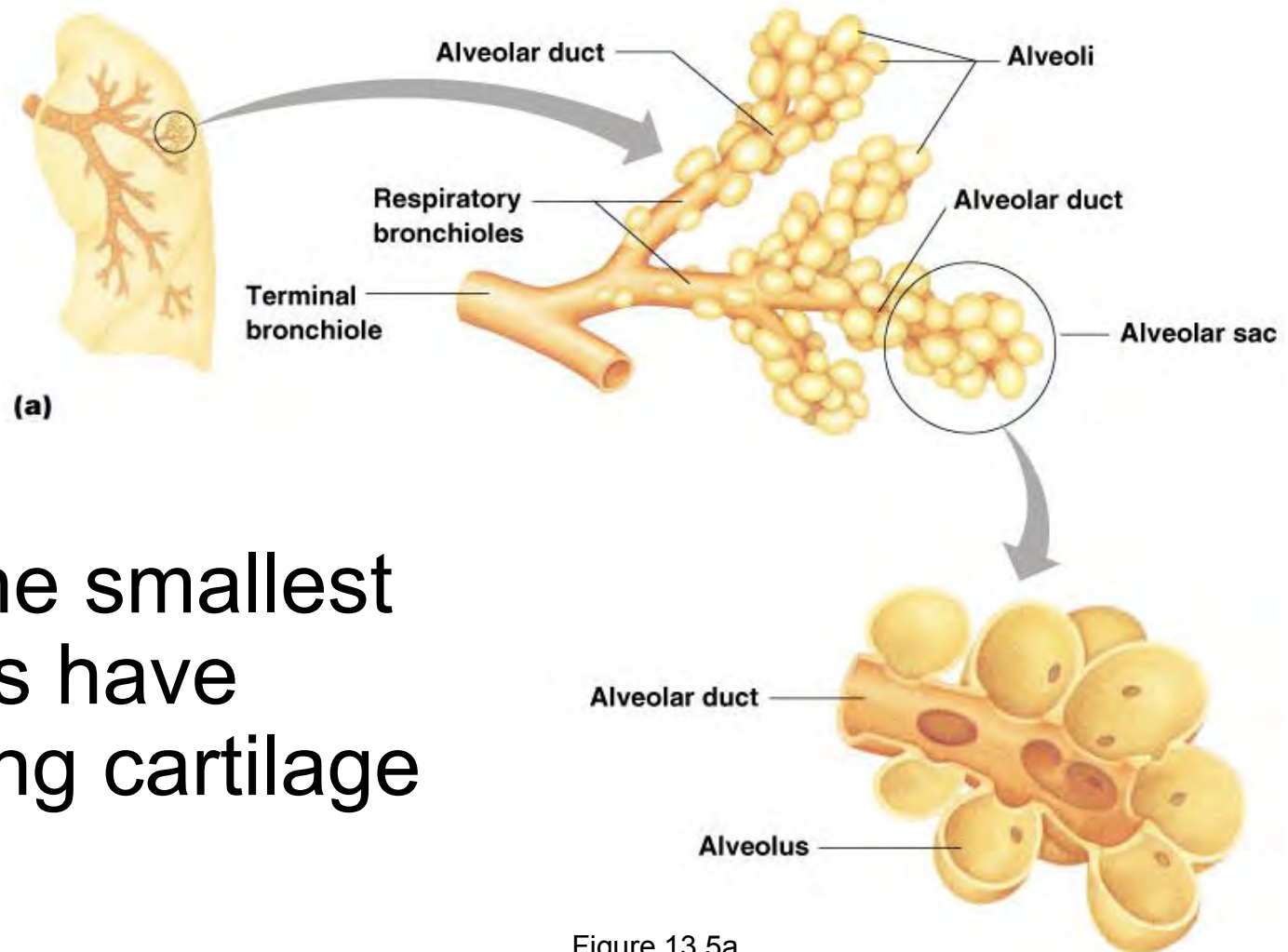
Bronchioles



- Smallest branches of the bronchi

Figure 13.5a

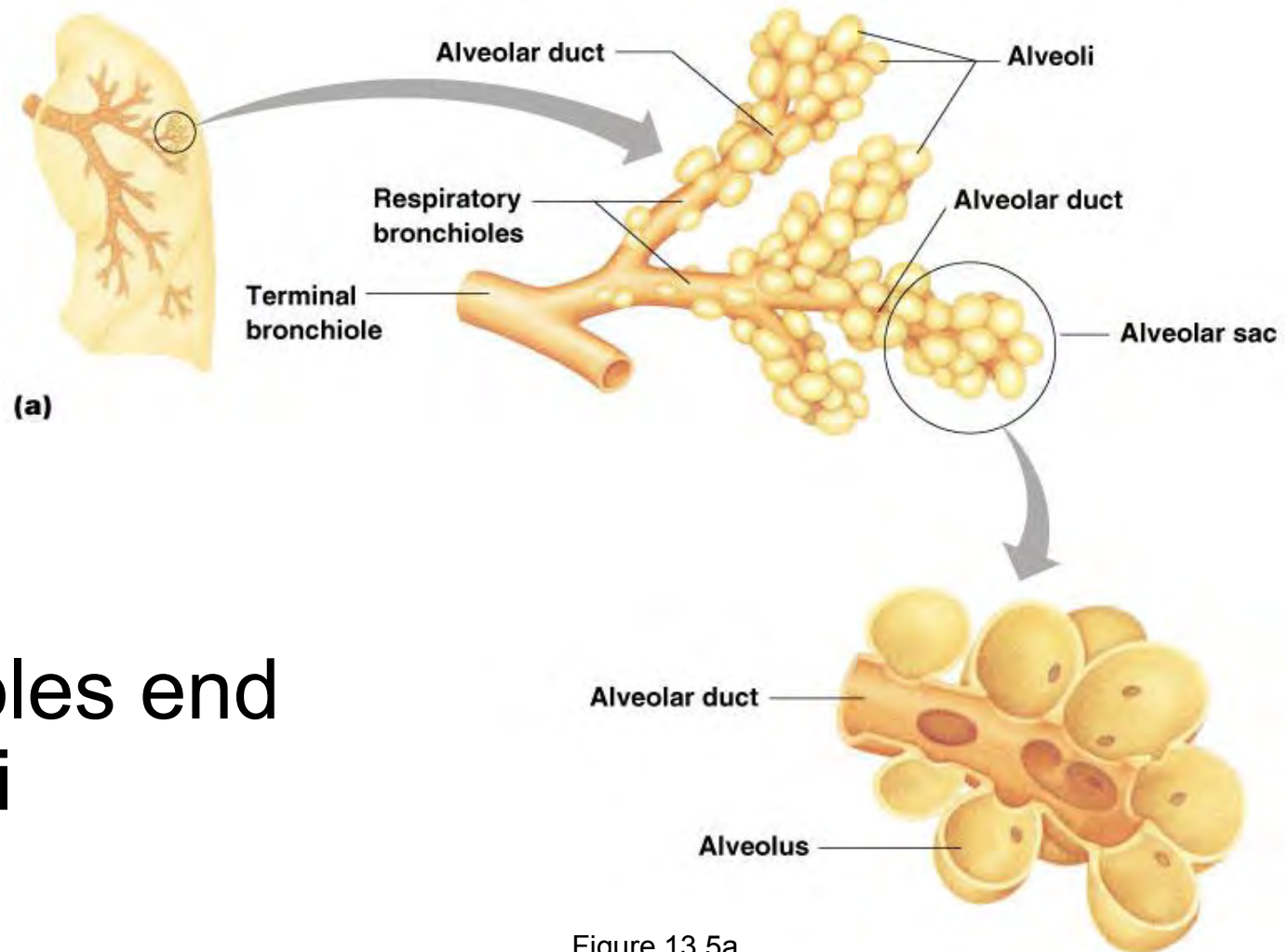
Bronchioles



- All but the smallest branches have reinforcing cartilage

Figure 13.5a

Bronchioles



- Terminal bronchioles end in alveoli

Figure 13.5a

Alveoli

- **Structure of alveoli**
 - **Alveolar duct**
 - **Alveolar sac**
 - **Alveolus**
- **Gas exchange takes place within the alveoli in the respiratory membrane**
 - **Thin squamous epithelial layer lining alveolar walls**
 - **Pulmonary capillaries cover external surfaces of alveoli**

Respiratory Membrane (Air-Blood Barrier)

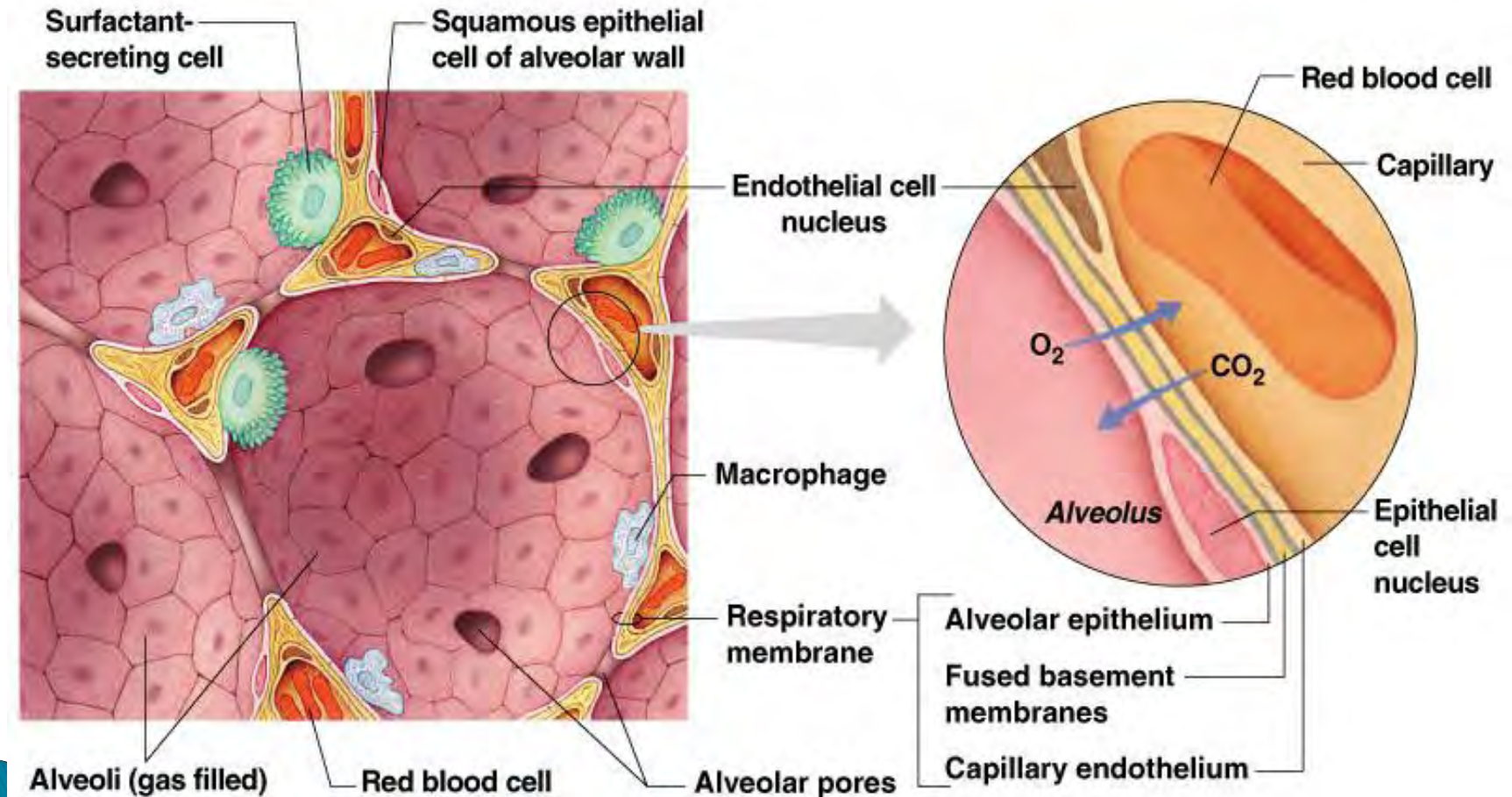


Figure 13.6

Slide 13.18b

Gas Exchange

- Gas crosses the respiratory membrane by diffusion
 - Oxygen enters the blood
 - Carbon dioxide enters the alveoli
- Macrophages add protection
- Surfactant coats gas-exposed alveolar surfaces

Events of Respiration

- **Pulmonary ventilation – moving air in and out of the lungs**
- **External respiration – gas exchange between pulmonary blood and alveoli**
- **Respiratory gas transport – transport of oxygen and carbon dioxide via the bloodstream**
- **Internal respiration – gas exchange between blood and tissue cells in systemic capillaries**

Mechanics of Breathing (Pulmonary Ventilation)

- Completely mechanical process
- Depends on volume changes in the thoracic cavity
- Volume changes lead to pressure changes, which lead to the flow of gases to equalize pressure

Mechanics of Breathing (Pulmonary Ventilation)

- Two phases
 - Inspiration – flow of air into lung
 - Diaphragm and intercostal muscles contract
 - The size of the thoracic cavity increases
 - External air is pulled into the lungs due to an increase in intrapulmonary volume

Inspiration

Changes in anterior-posterior and superior-inferior dimensions



Changes in lateral dimensions

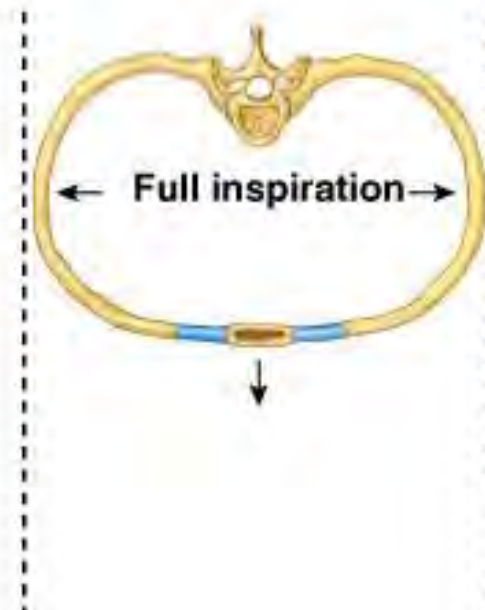


Figure 13.7a

Exhalation: air leaving the lungs

- Largely a passive process which depends on natural lung elasticity
- As muscles relax, air is pushed out of the lungs
- Forced expiration can occur mostly by contracting internal intercostal muscles to depress the rib cage

Exhalation

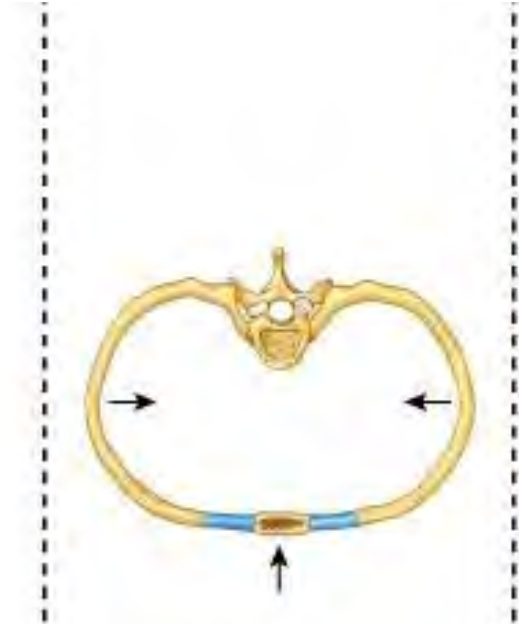


Figure 13.7b

Pressure Differences in the Thoracic Cavity

- Normal pressure within the pleural space is always negative (intrapleural pressure)
- Differences in lung and pleural space pressures keep lungs from collapsing

Respiratory Volumes and Capacities

- Normal breathing moves about 500 ml of air with each breath (tidal volume [TV])
- Many factors that affect respiratory capacity
 - A person's size
 - Sex
 - Age
 - Physical condition
- Residual volume of air – after exhalation, about 1200 ml of air remains in the lungs

Respiratory Volumes and Capacities

- Inspiratory reserve volume (IRV)
 - Amount of air that can be taken in forcibly over the tidal volume
 - Usually between 2100 and 3200 ml
- Expiratory reserve volume (ERV)
 - Amount of air that can be forcibly exhaled
 - Approximately 1200 ml
- Residual volume
 - Air remaining in lung after expiration
 - About 1200 ml

Respiratory Volumes and Capacities

- Vital capacity
 - The total amount of exchangeable air
 - $\text{Vital capacity} = \text{TV} + \text{IRV} + \text{ERV}$
- Dead space volume
 - Air that remains in conducting zone and never reaches alveoli
 - About 150 ml
- Functional volume
 - Air that actually reaches the respiratory zone
 - Usually about 350 ml
 - Respiratory capacities are measured with a spirometer

Respiratory Capacities

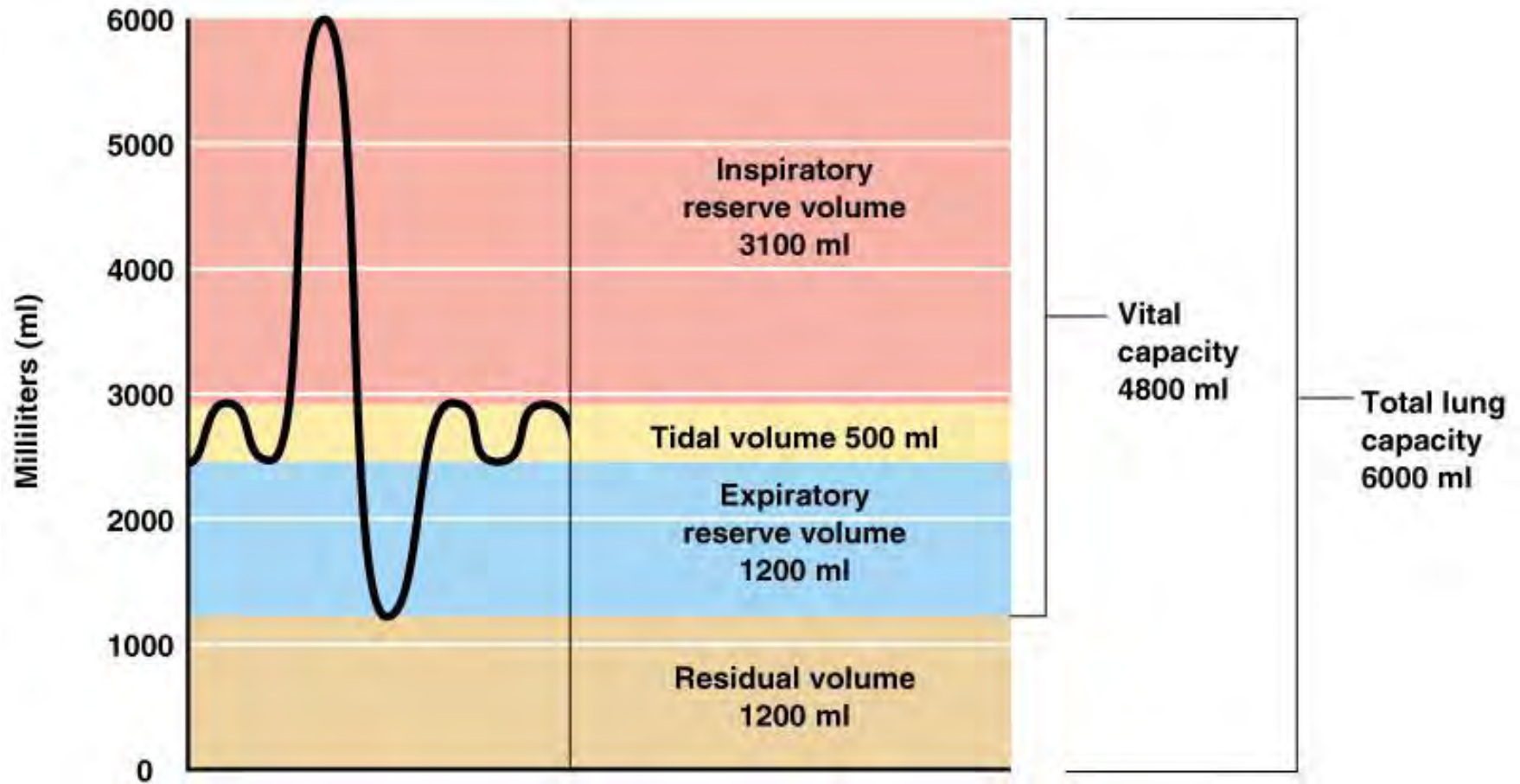


Figure 13.9

External Respiration

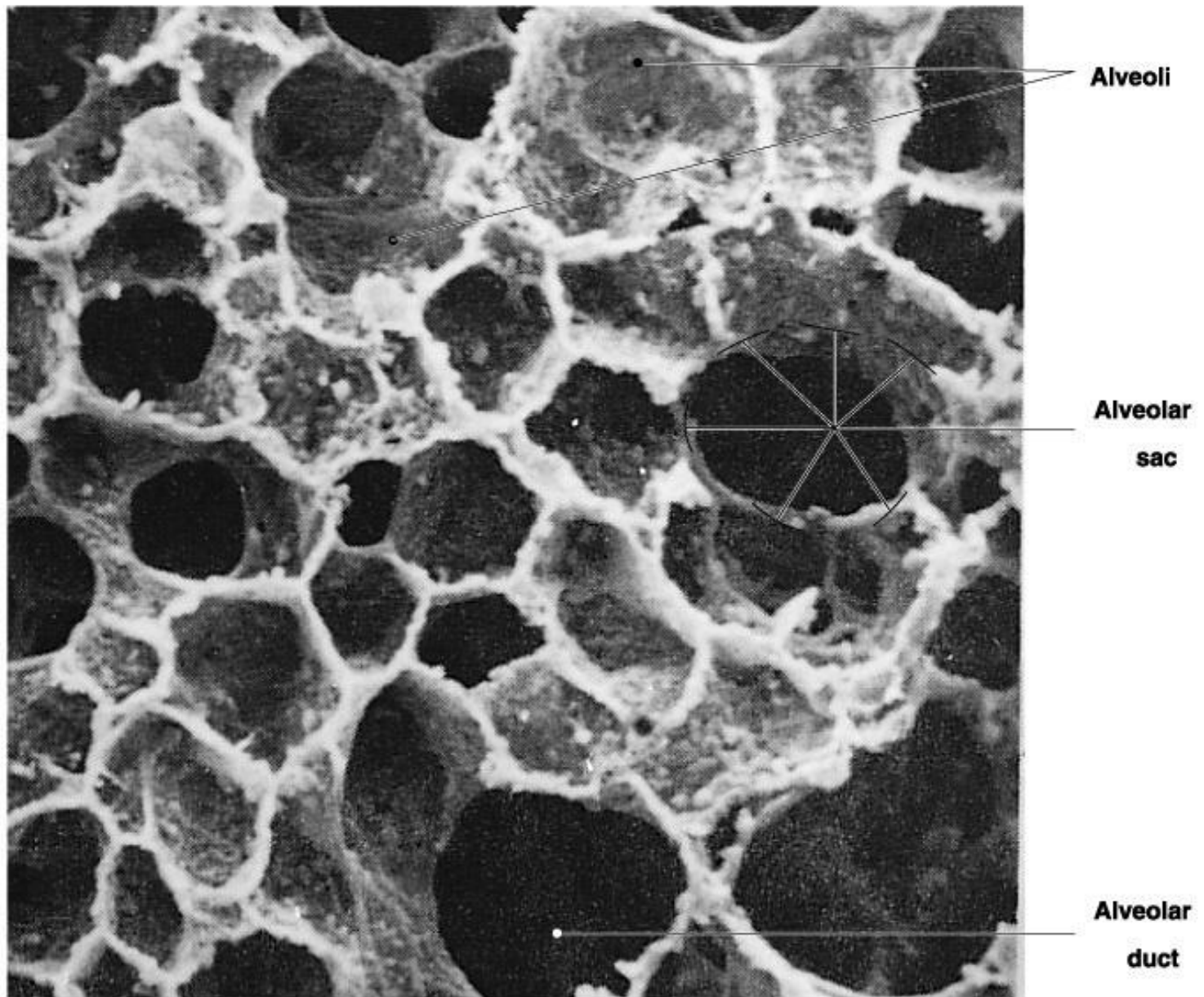
- Oxygen movement into the blood
 - The alveoli always has more oxygen than the blood
 - Oxygen moves by diffusion towards the area of lower concentration
 - Pulmonary capillary blood gains oxygen
- Carbon dioxide movement out of the blood
 - Blood returning from tissues has higher concentrations of carbon dioxide than air in the alveoli
 - Pulmonary capillary blood gives up carbon dioxide
 - Blood leaving the lungs is oxygen-rich and carbon dioxide-poor

Gas Transport in the Blood

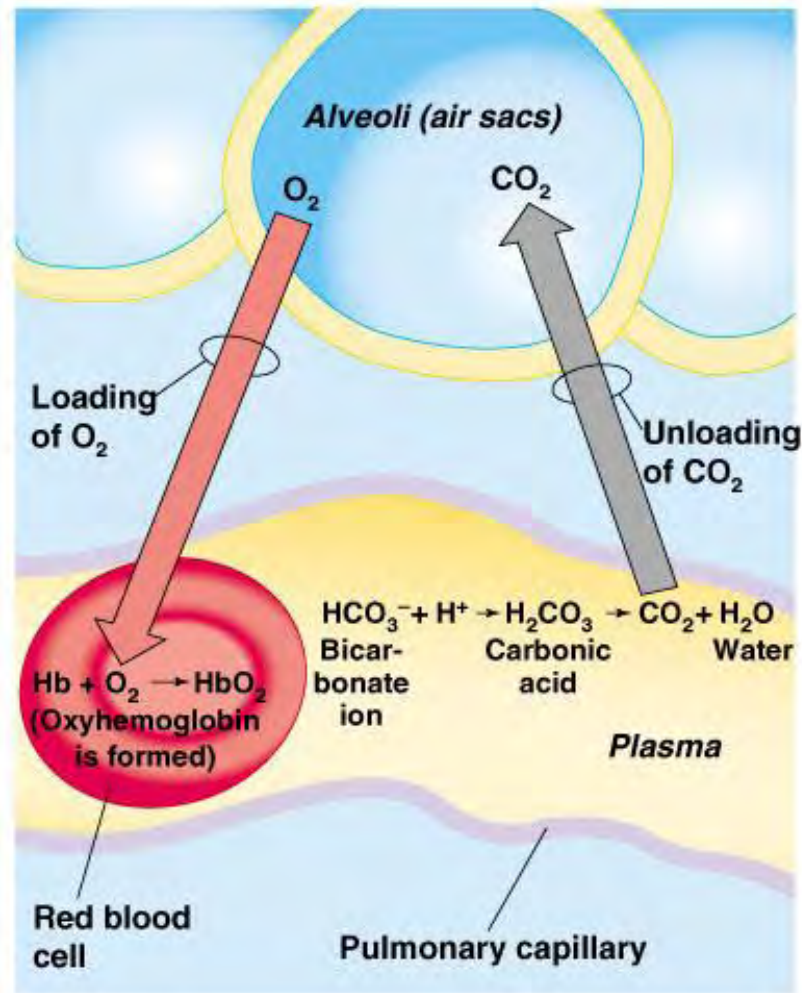
- **Oxygen transport in the blood**
 - **Inside red blood cells attached to hemoglobin (oxyhemoglobin [HbO₂])**
 - **A small amount is carried dissolved in the plasma**
- **Carbon dioxide transport in the blood**
 - **Most is transported in the plasma as bicarbonate ion (HCO₃⁻)**
 - **A small amount is carried inside red blood cells on hemoglobin, but at different binding sites than those of oxygen**

Internal Respiration

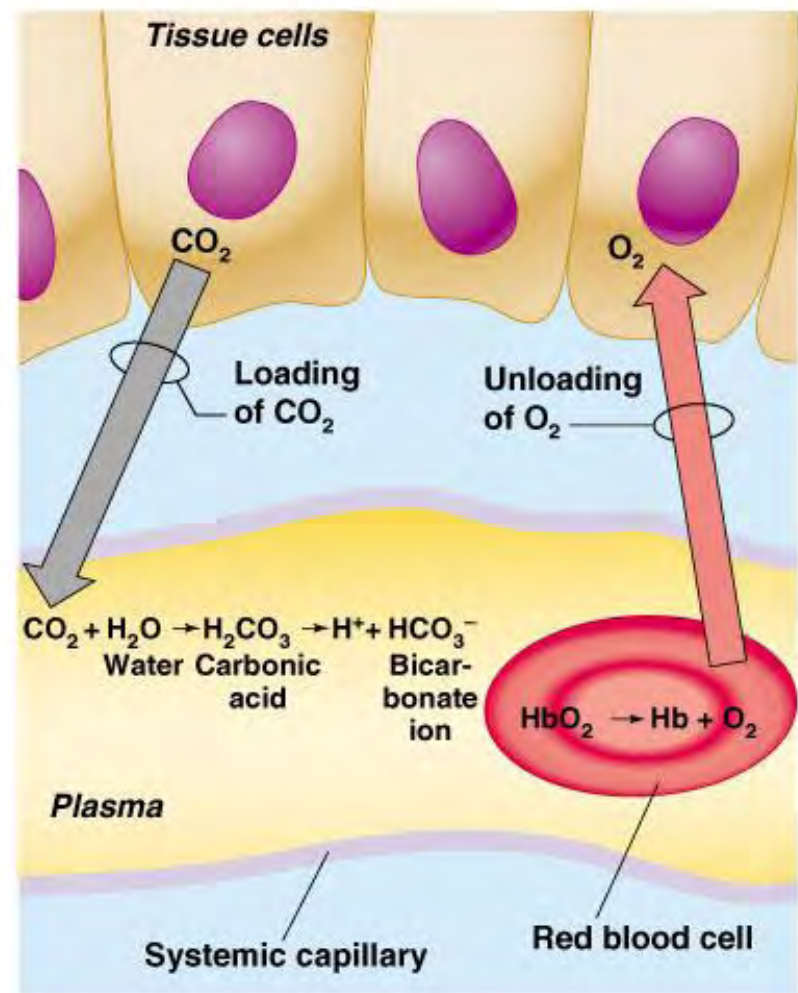
- Exchange of gases between blood and body cells
- An opposite reaction to what occurs in the lungs
 - Carbon dioxide diffuses out of tissue to blood
 - Oxygen diffuses from blood into tissue



Internal Respiration



(a)



(b)

Figure 13.11

Slide 13.34b

External Respiration, Gas Transport, and Internal Respiration Summary

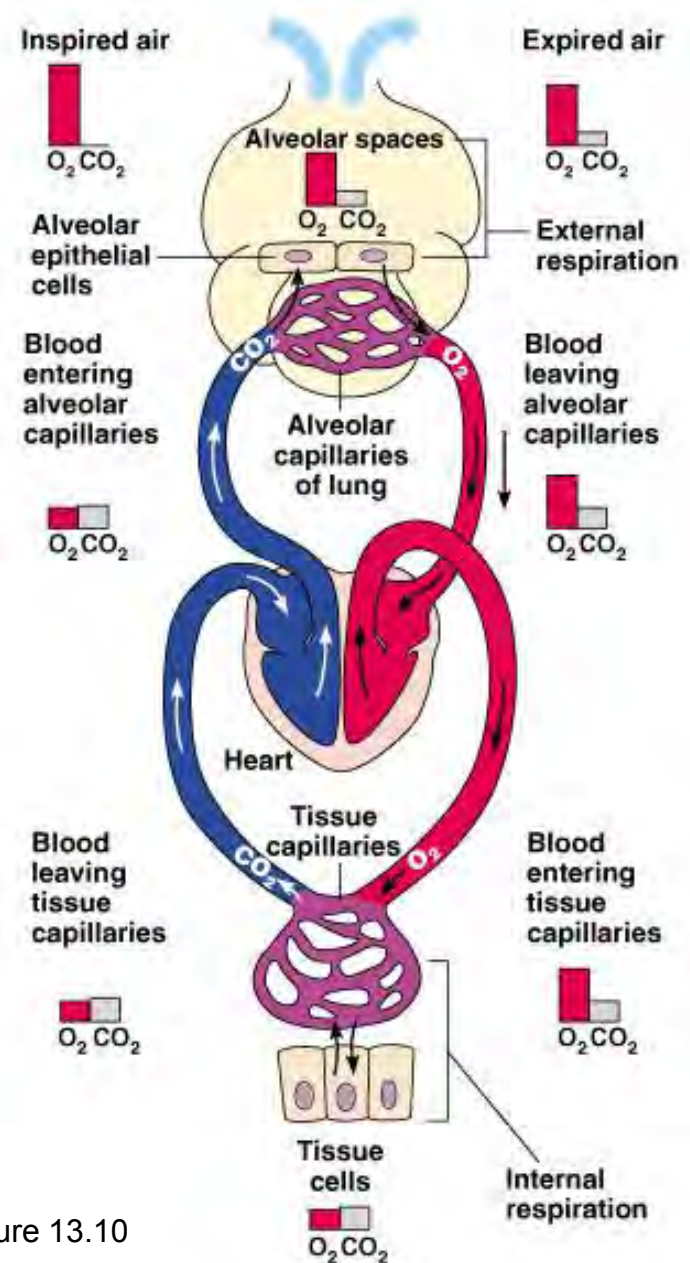


Figure 13.10

Neural Regulation of Respiration

- Activity of respiratory muscles is transmitted to the brain by the phrenic and intercostal nerves
- Neural centers that control rate and depth are located in the medulla
- The pons appears to smooth out respiratory rate
- Normal respiratory rate (eupnea) is 12–15 respirations per minute
- Hyperpnea is increased respiratory rate often due to extra oxygen needs

Neural Regulation of Respiration

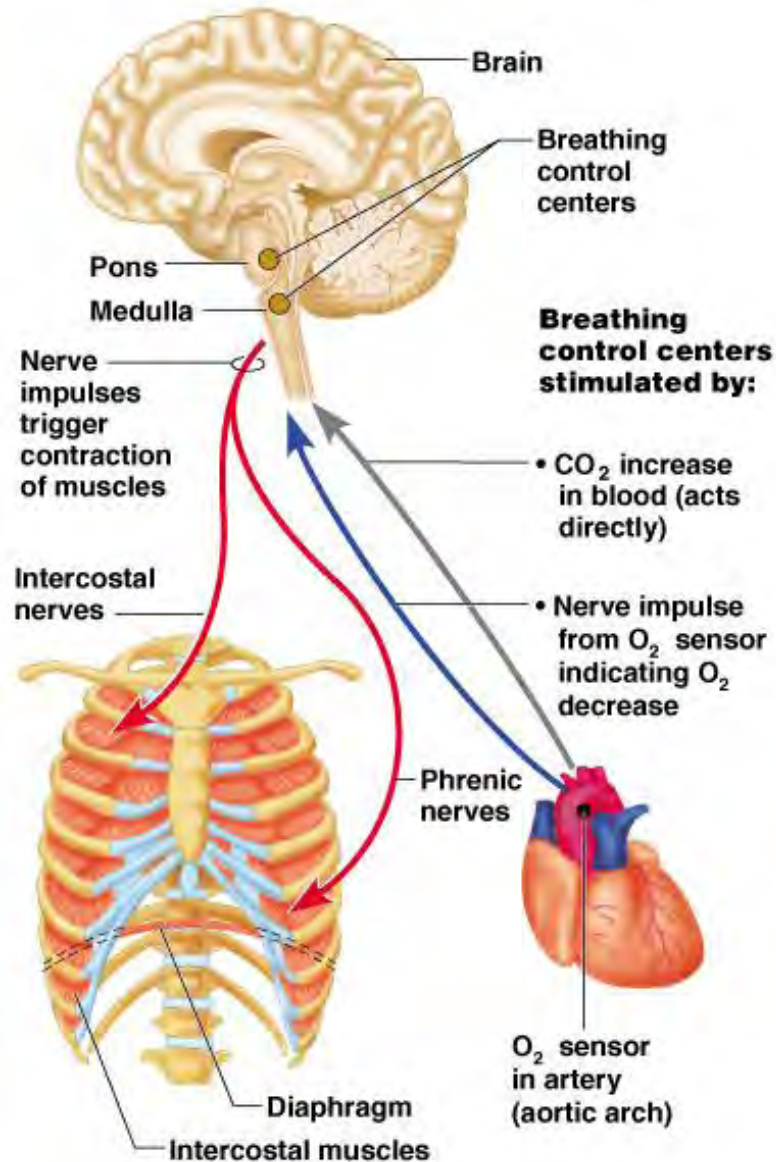


Figure 13.12

Factors Influencing Respiratory Rate and Depth

- Physical factors
 - Increased body temperature
 - Exercise
 - Talking
 - Coughing
- Volition (conscious control)
- Emotional factors

Factors Influencing Respiratory Rate and Depth

- **Chemical factors**
 - **Carbon dioxide levels**
 - **Level of carbon dioxide in the blood is the main regulatory chemical for respiration**
 - **Increased carbon dioxide increases respiration**
- **Oxygen levels**
 - **Changes in oxygen concentration in the blood are detected by chemoreceptors in the aorta and carotid artery**
 - **Information is sent to the medulla oblongata**

Respiratory Disorders: Chronic Obstructive Pulmonary Disease (COPD)

- **Features of these diseases**
 - **Patients almost always have a history of smoking**
 - **Labored breathing (dyspnea) becomes progressively more severe**
 - **Coughing and frequent pulmonary infections are common**
- **Features of these diseases (continued)**
 - **Most victims retain carbon dioxide, are hypoxic and have respiratory acidosis**
 - **Those infected will ultimately develop respiratory failure**

Chronic Obstructive Pulmonary Disease (COPD)

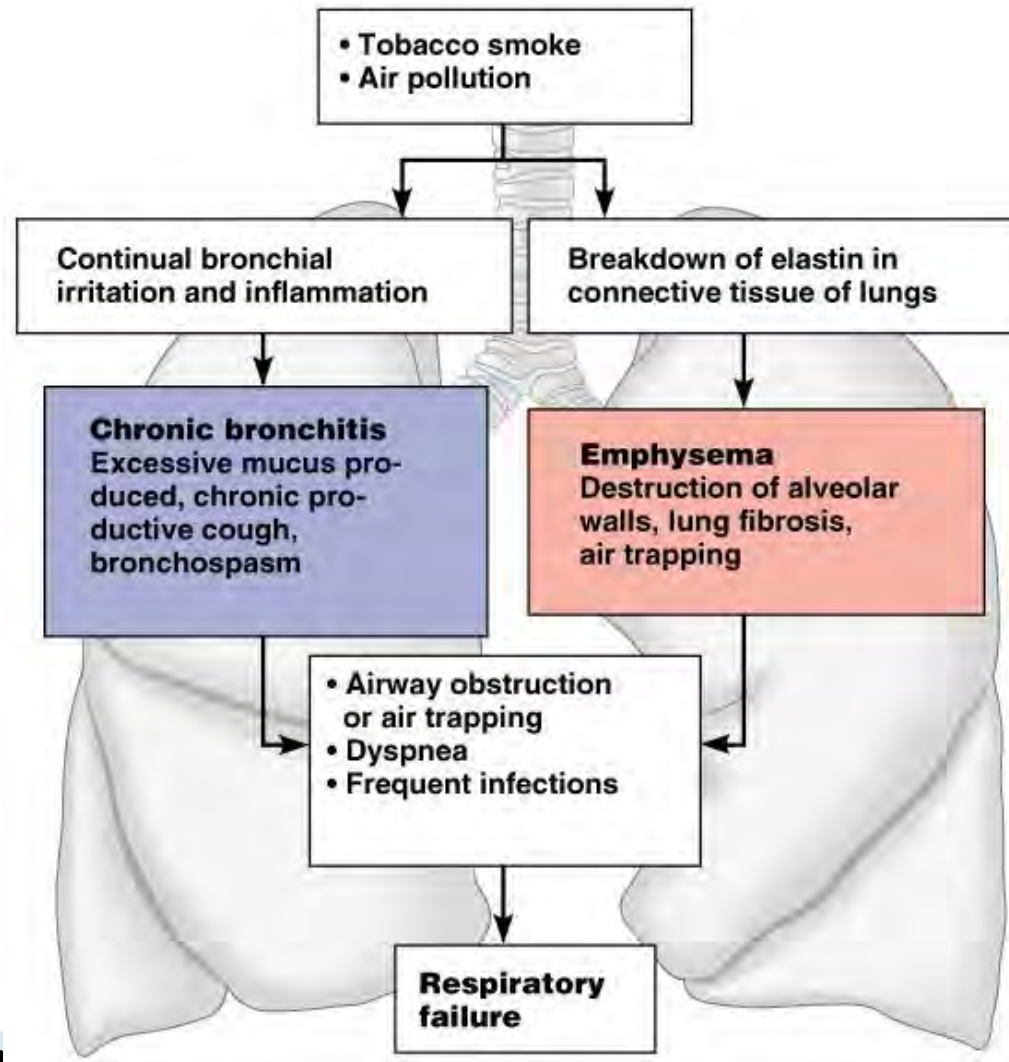


Figure 13.13