

ADVANCED ASSESSMENT

Respiratory System

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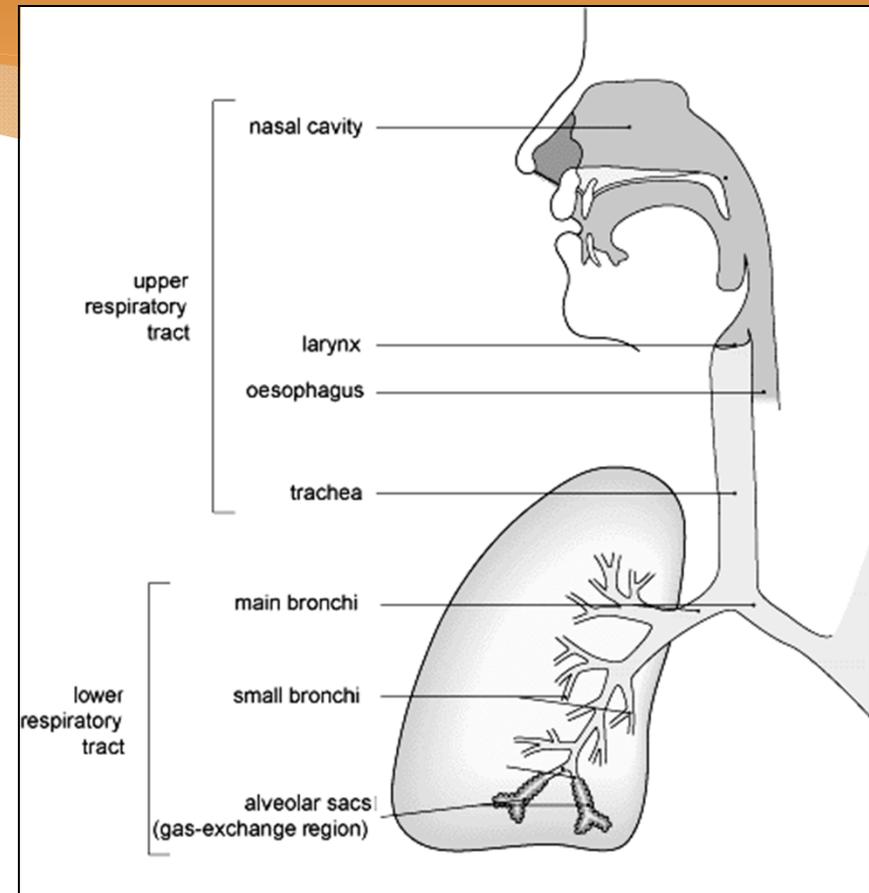
References- Emergency Medicine

2014 Ontario Base Hospital Group

Respiratory System

CONSISTS OF:

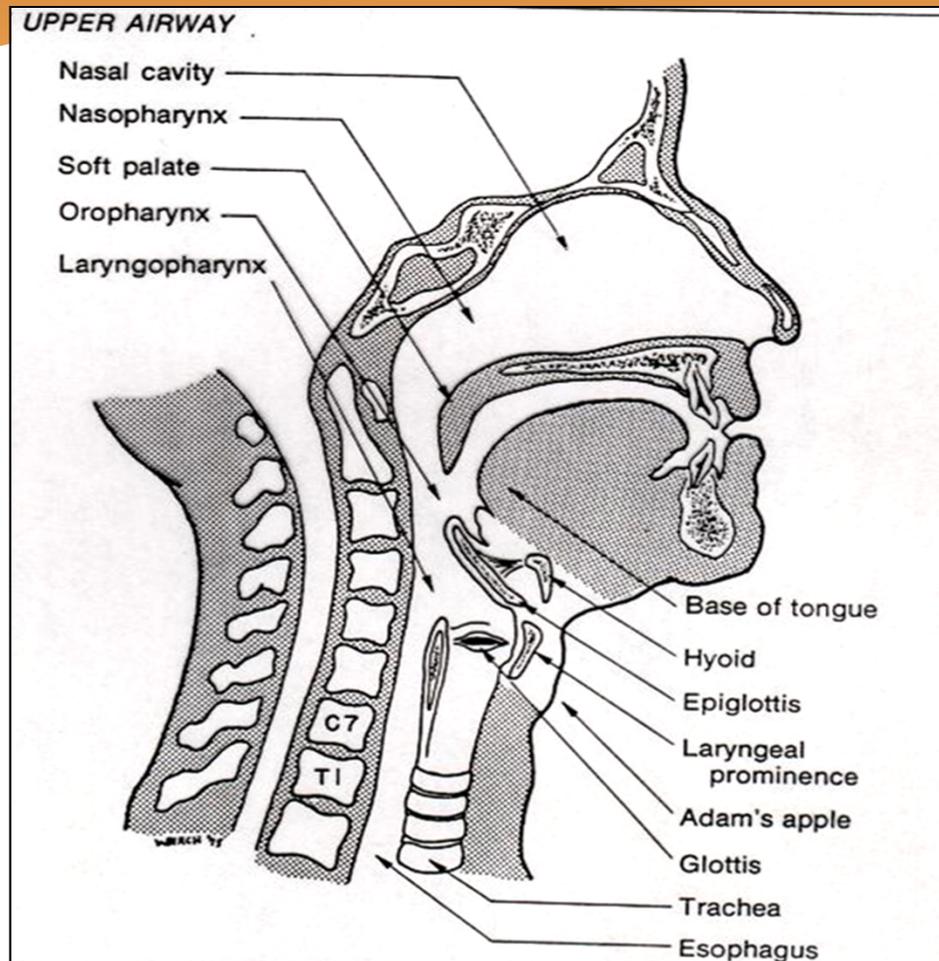
- ◆ Upper Respiratory Tract
- ◆ Lower Respiratory Tract



Functions

- ◆ Route for air exchange
- ◆ Warms and moistens air
- ◆ Traps/filters particles (nares)
- ◆ Supply of oxygen
- ◆ Removal of carbon dioxide
- ◆ Removal of other wastes

Upper Respiratory Tract



- ◆ Nasal Cavity and Sinuses
- ◆ Pharynx
- ◆ Larynx
- ◆ Trachea

Upper Respiratory Tract

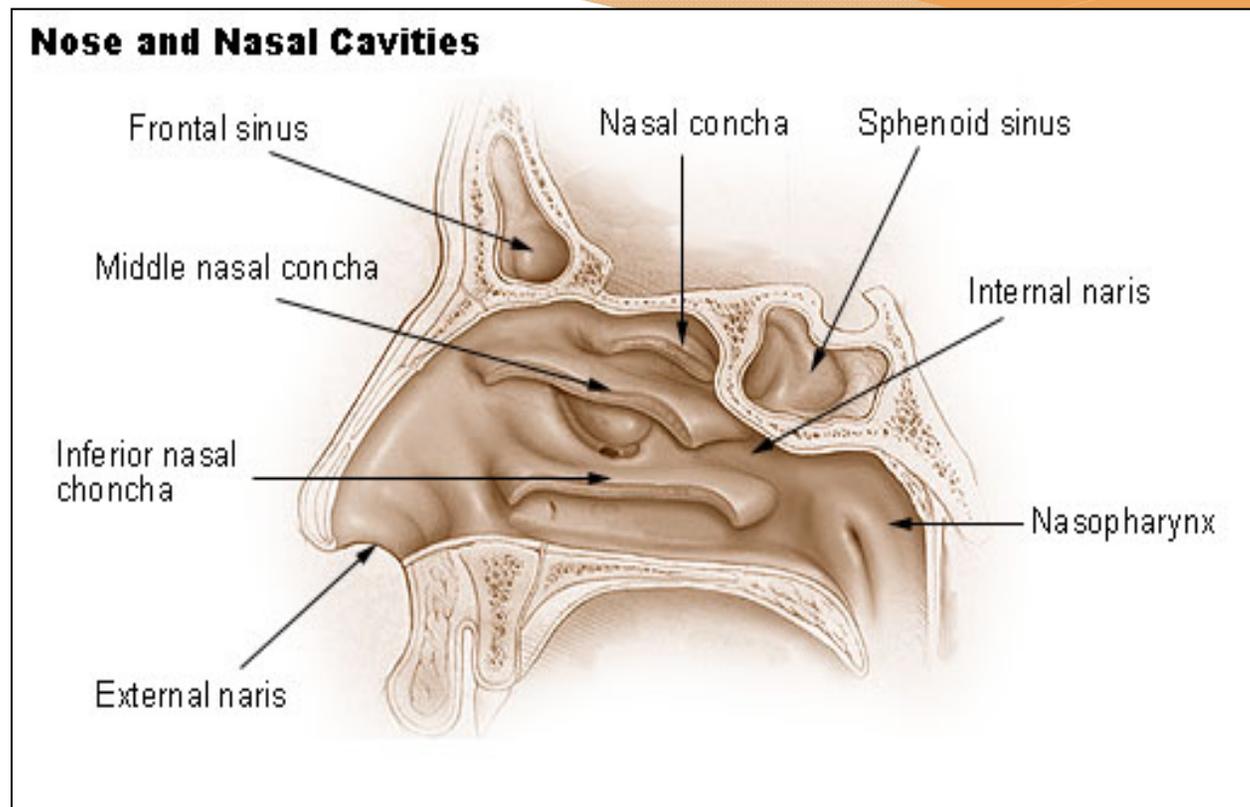
Purpose

- ◆ Warms
- ◆ Moistens
- ◆ Filters
- ◆ Conveys air to the lower Respiratory Tract

What about an intubated patient?

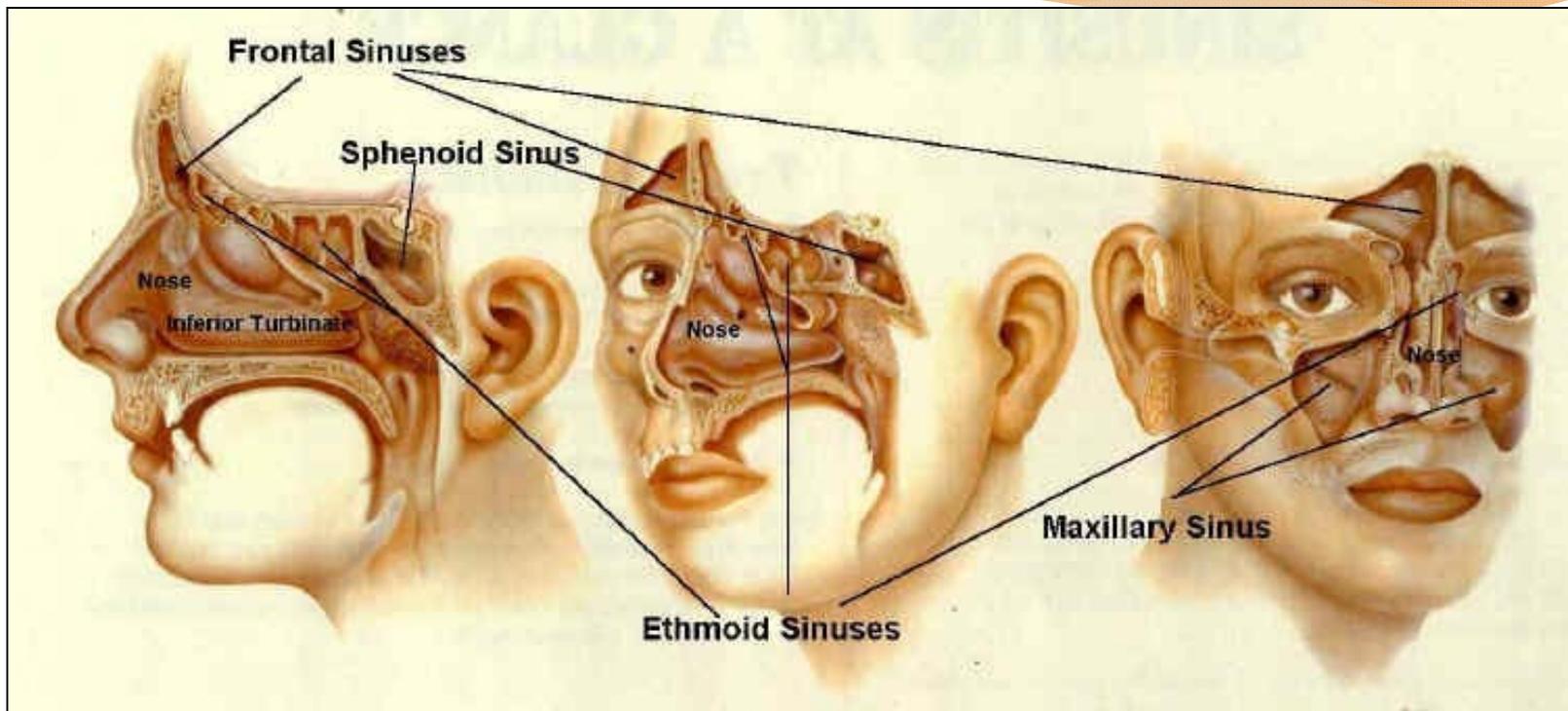
Upper Respiratory Tract

- ◆ Nasal Cavity



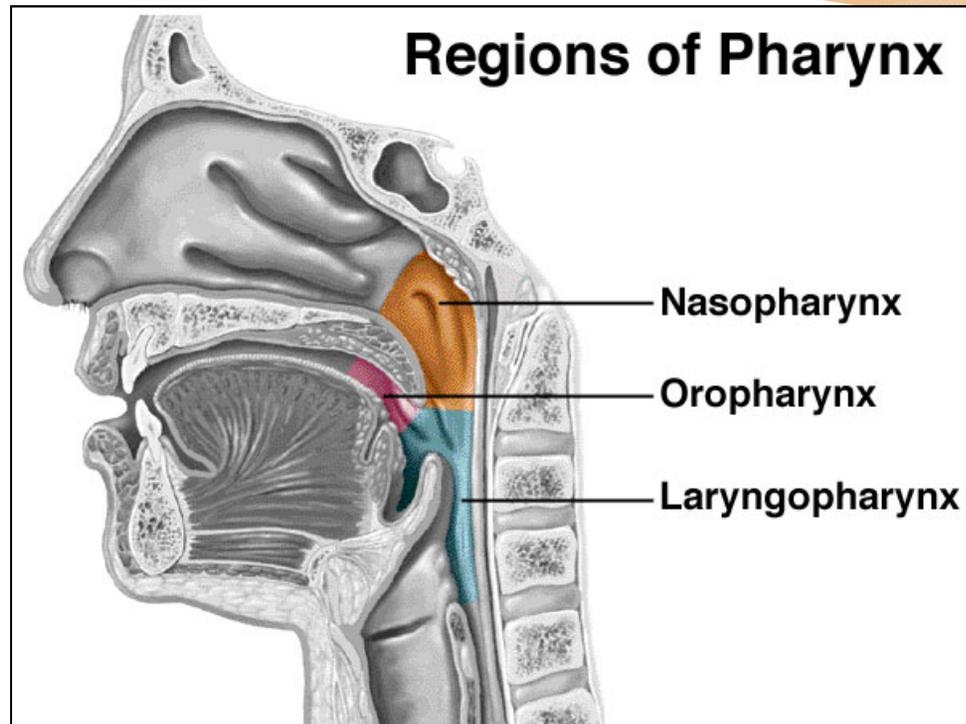
Upper Respiratory Tract

- ◆ Nasal Sinuses



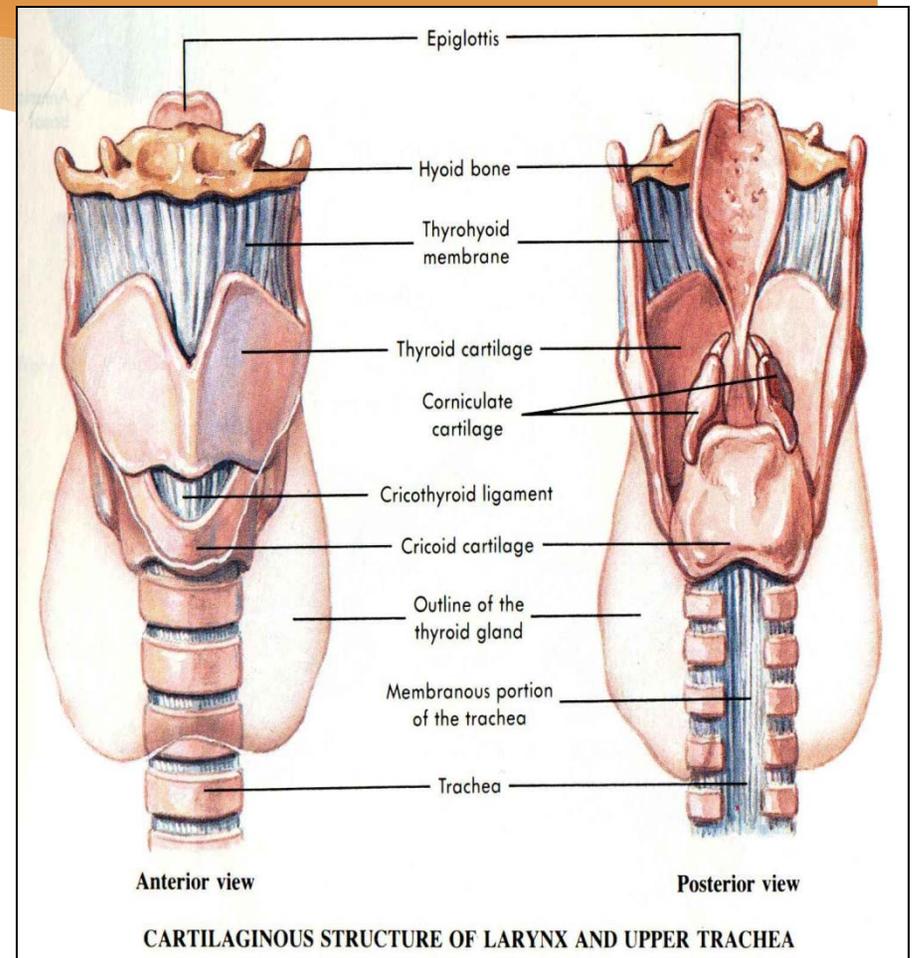
Upper Respiratory Tract

- ◆ Pharynx



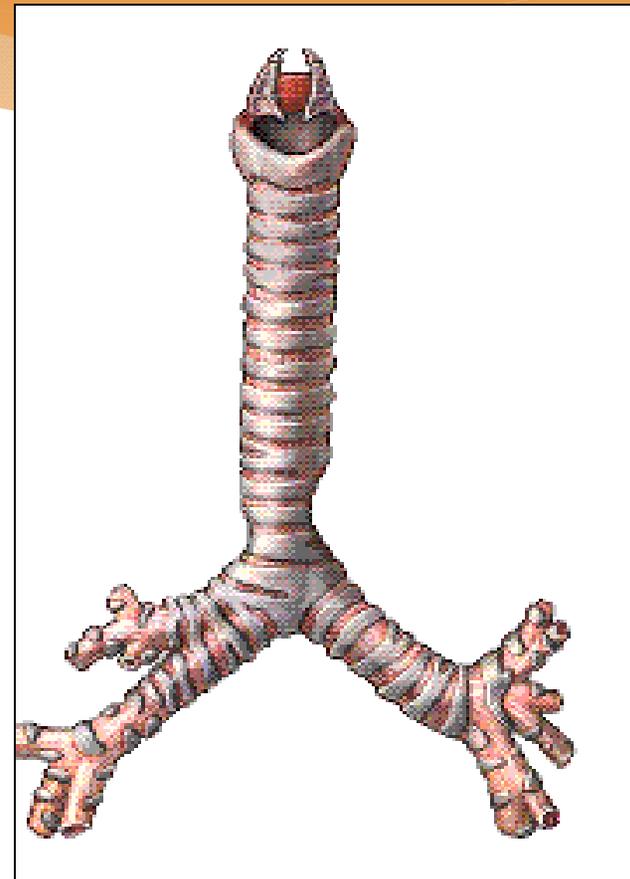
Upper Respiratory Tract

- ◆ Larynx
 - ◆ Level C3-→ C6
 - ◆ Extends from hyoid bone to lower border of cricoid (made up of cartilage, joined by ligaments, lined with mucous membrane)
 - ◆ 4 Major Cartilages
 - ◆ Epiglottis, Thyroid, Arytenoid, Cricoid



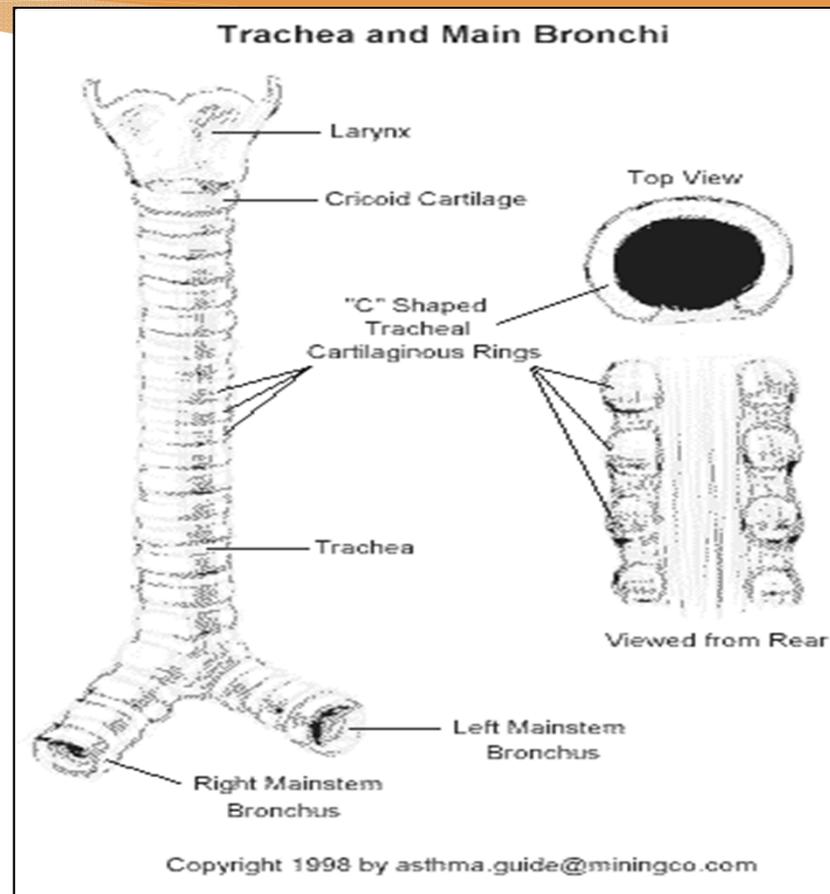
Upper Respiratory Tract

- ◆ Trachea
- ◆ C6 To T5
- ◆ From Cricoid to Carina (10cm)
- ◆ First ring only solid one of trachea
- ◆ 16-20 horseshoe shaped cartilages
- ◆ Ciliated columnar epithelium
- ◆ Bifurcates at carina



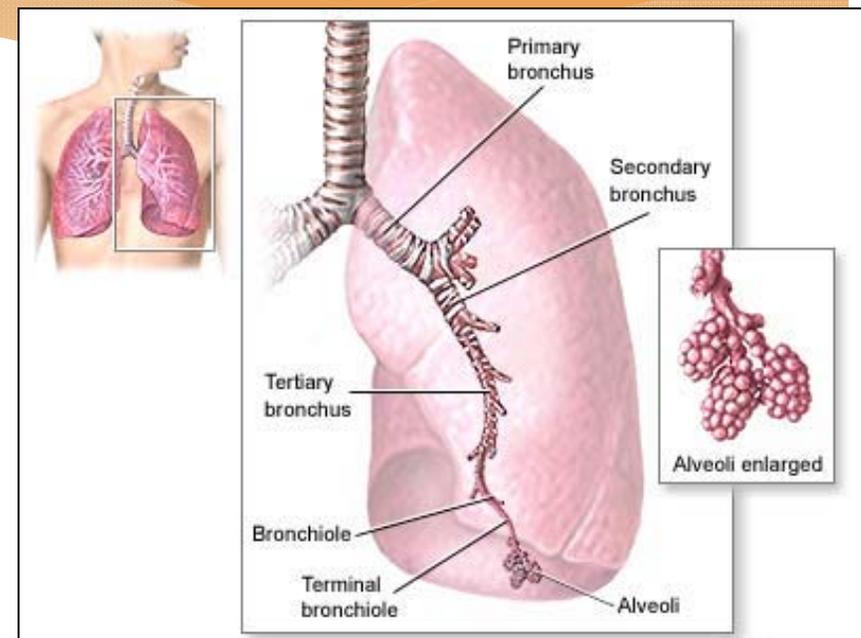
Upper Respiratory Tract

- ◆ Trachea



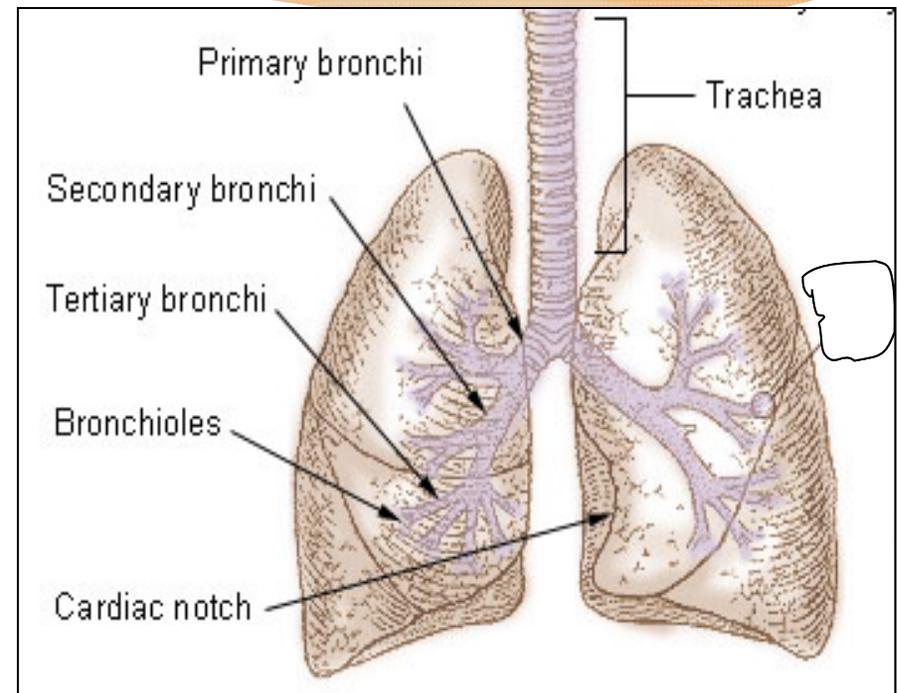
Lower Respiratory Tract

- ◆ Right and Left main stem bronchi
- ◆ Secondary Bronchi
- ◆ Tertiary Bronchi
- ◆ Bronchioles
- ◆ Terminal Bronchioles
- ◆ Respiratory Bronchioles
- ◆ Alveolar Ducts
- ◆ Alveolar Sacs
- ◆ Alveoli



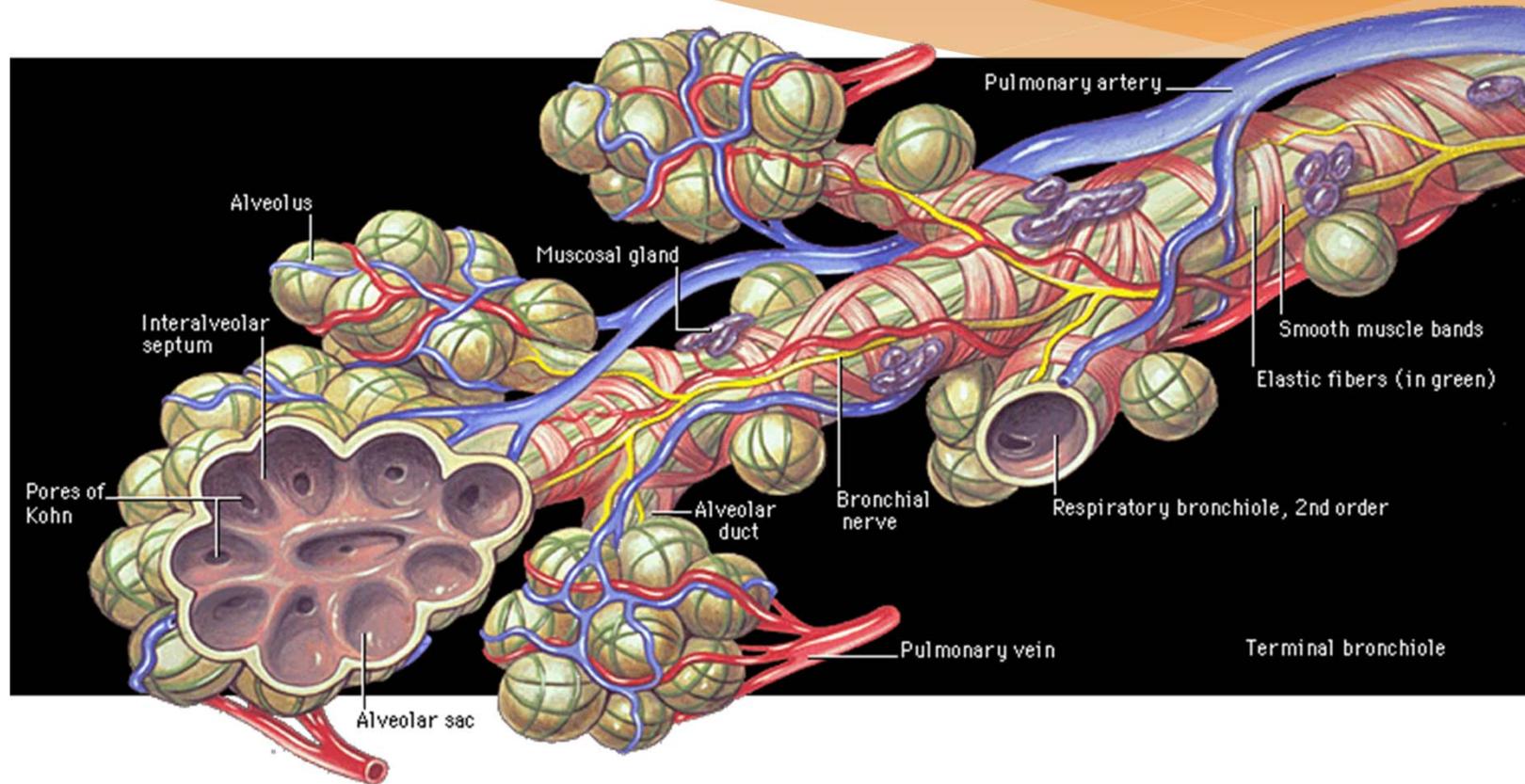
Lower Respiratory Tract

- ◆ Bronchial Tree
 - ◆ Right Mainstem
 - ◆ 5 cm long/ large caliber
 - ◆ Shorter more vertical (25 degree angle)
 - ◆ Foreign body obstruction
 - ◆ Left Mainstem
 - ◆ Longer than 5 cm
 - ◆ 45 degree angle



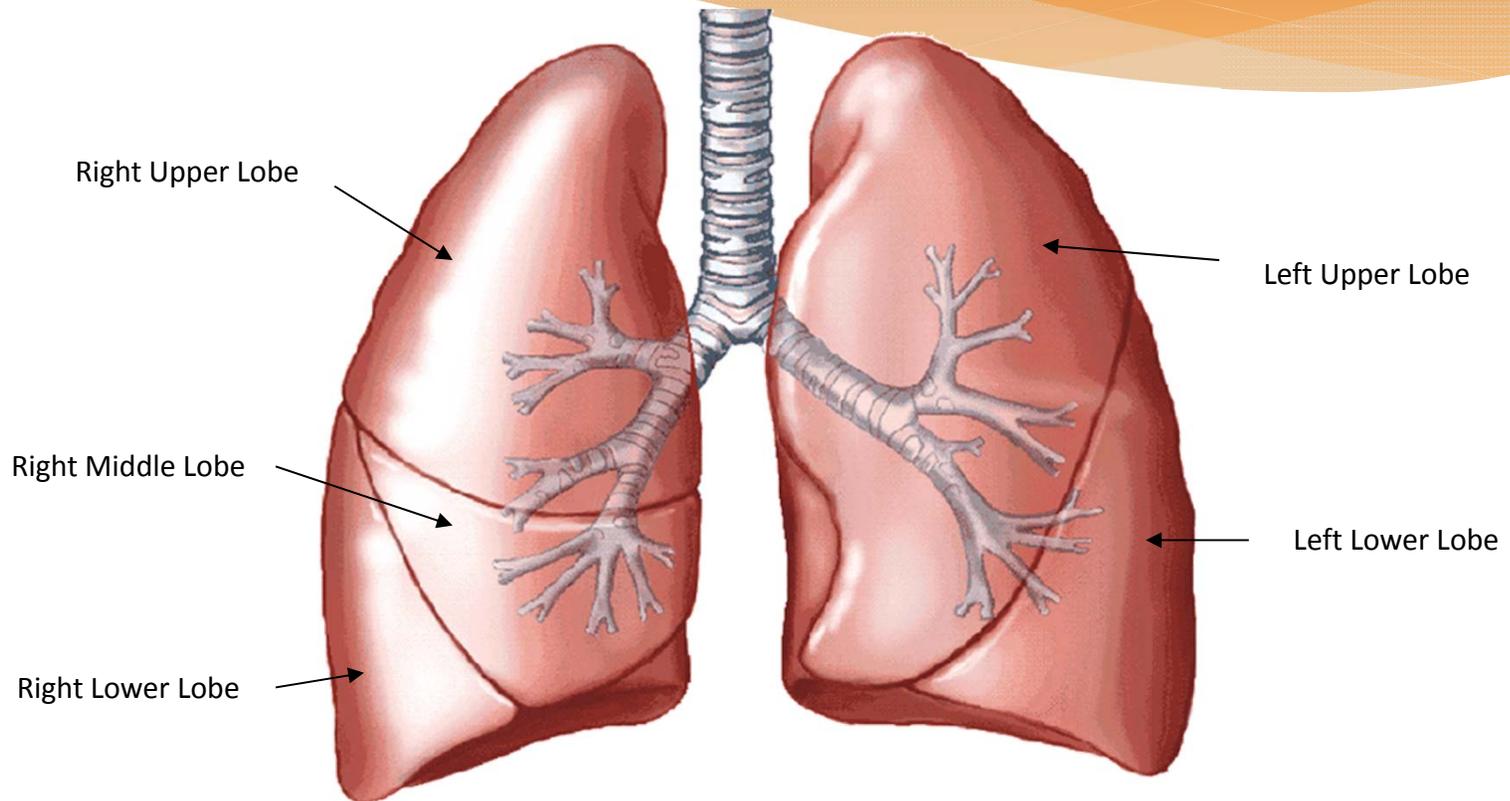
Lower Respiratory Tract

- ◆ Alveolus



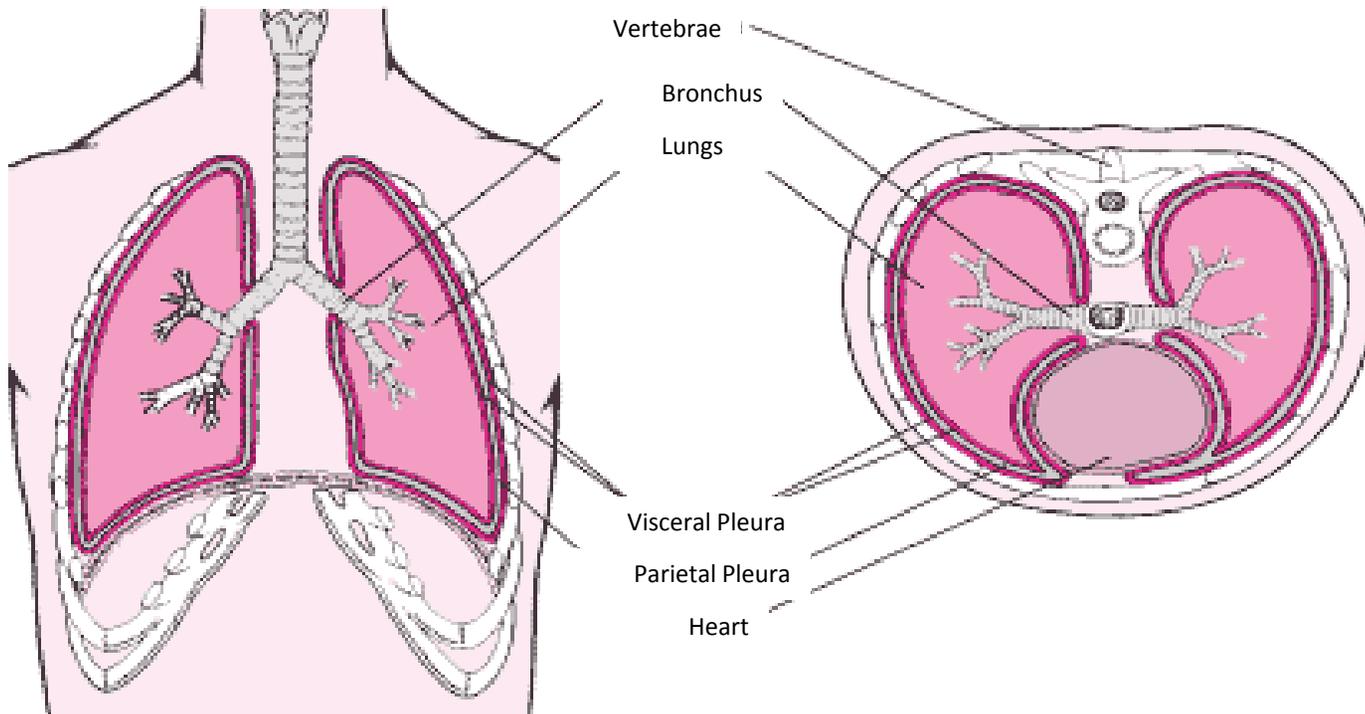
Lungs

- ◆ Lobes



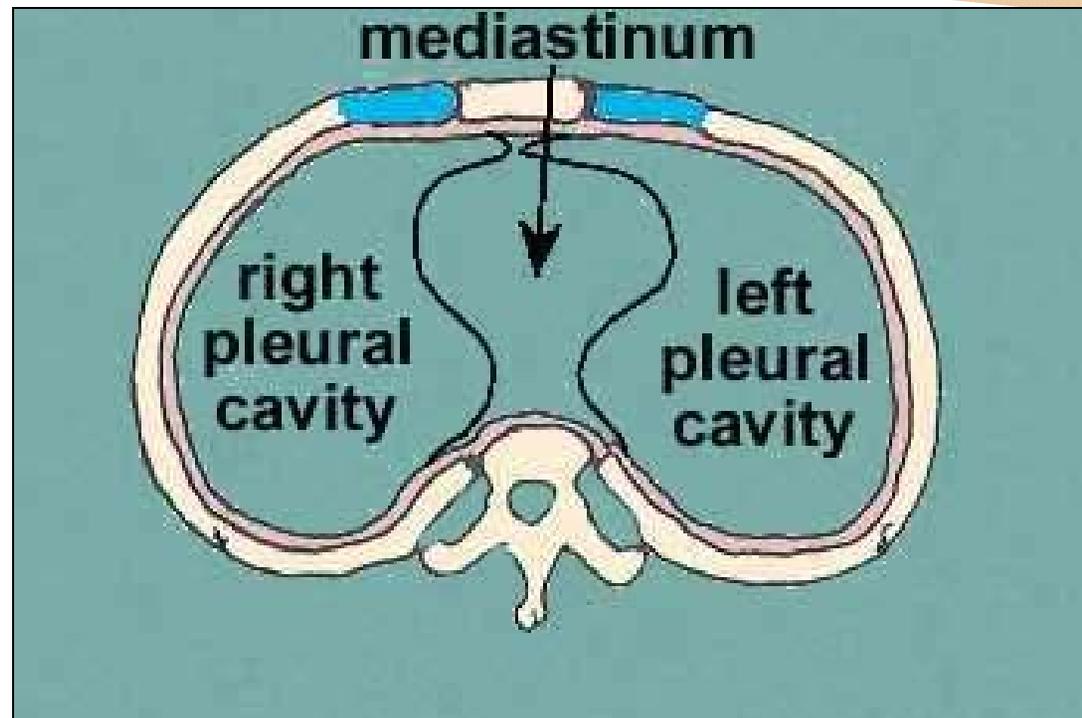
Lungs

- ◆ Pleura



Lungs

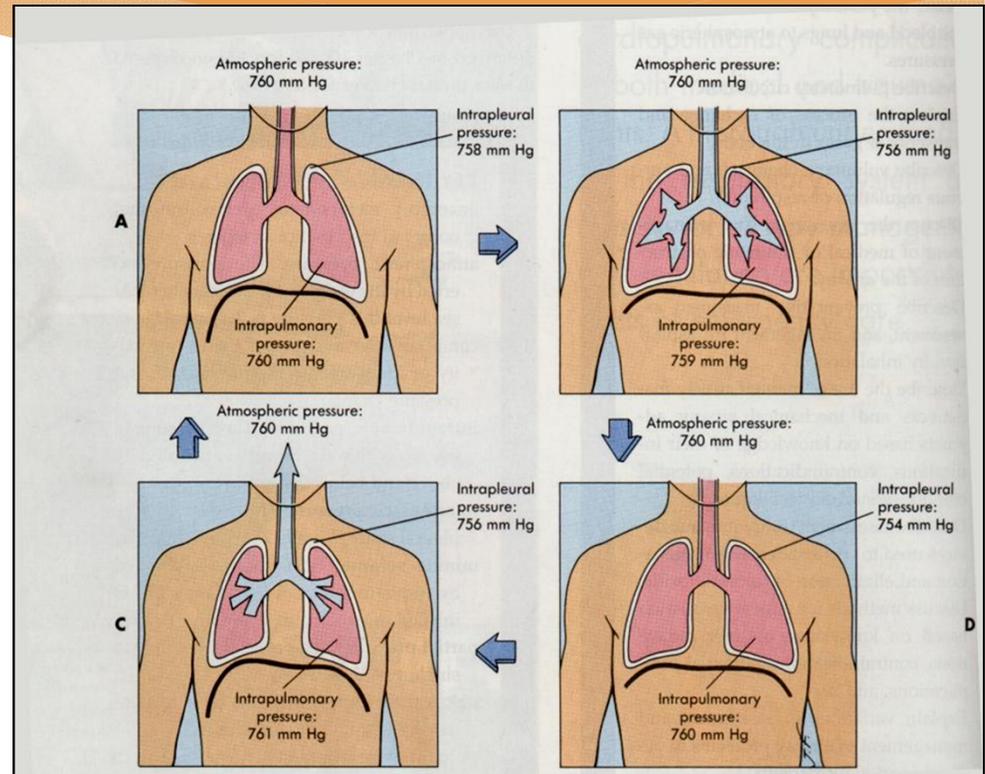
- ◆ Thoracic Cavity



Mechanics of Ventilation

Pressure Gradient

1. Alveolar \downarrow Atmosphere
2. Atmosphere \uparrow Alveolar



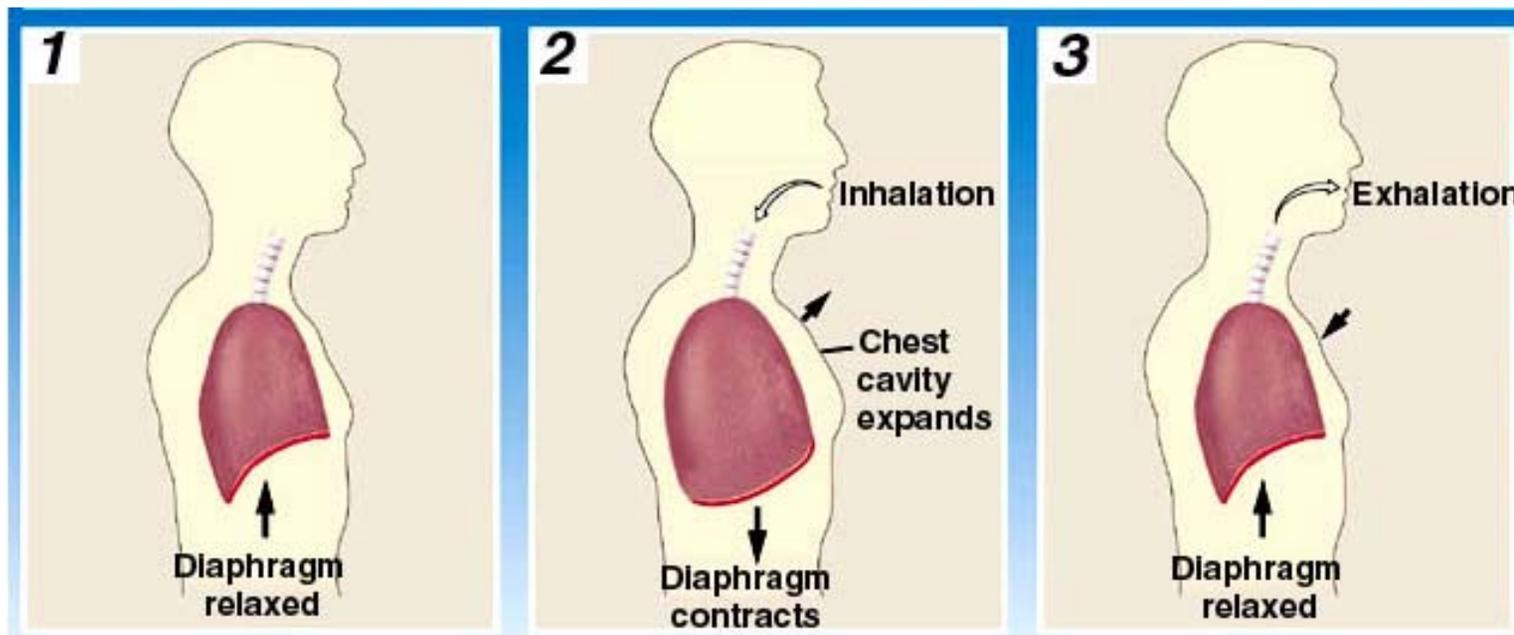
Mechanics of Ventilation

Inspiration

- ◆ ↑ Thoracic Cage
- ◆ ↓ 3 mmHg Alveolar Pressure

Exhalation

- ◆ ↓ Thoracic Cage
- ◆ Passive Process

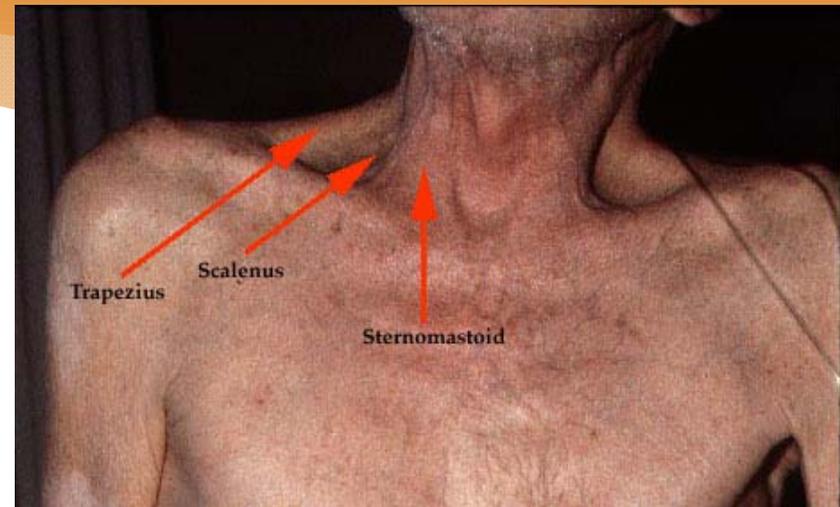


Mechanics of Ventilation

Accessory Muscles

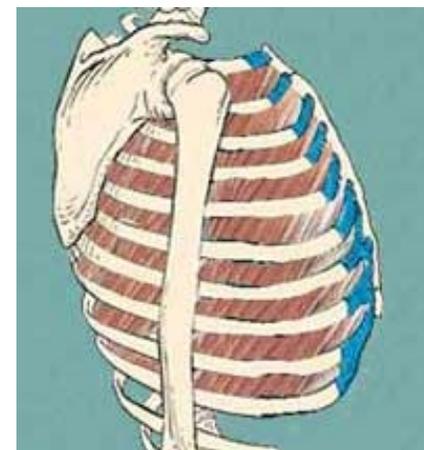
Inspiration

- ◆ Sternocleidomastoids
- ◆ Scalenes
- ◆ Trapezius



Exhalation

- ◆ Internal Intercostals
- ◆ Abdominals



Pulmonary Compliance

Amount of pressure required to expand the lungs

Decrease Compliance

Increased Compliance

Pulmonary Compliance

Surface Tension

- ◆ pressure exerted on alveolus due to cohesive forces of water molecules

What stops the lungs from collapsing?

Mechanical Work of Breathing

Key Terms

- ◆ Tidal Volume (T_V or V_T)
- ◆ Functional Residual Capacity (FRC)
- ◆ Total Lung Capacity
- ◆ Forced Vital Capacity

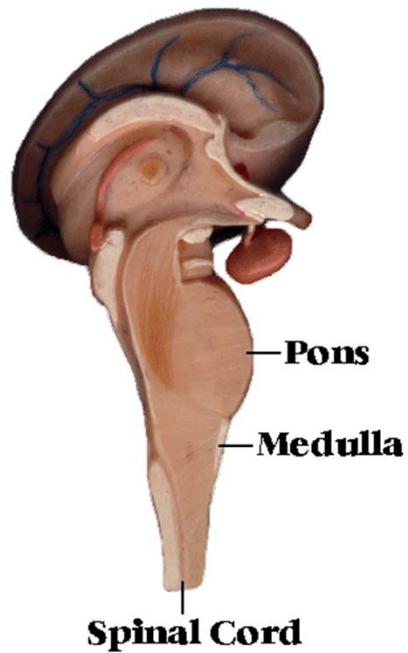
O₂ Consumption

- ◆ Normal Breathing – 5%
- ◆ Severe States – 25%

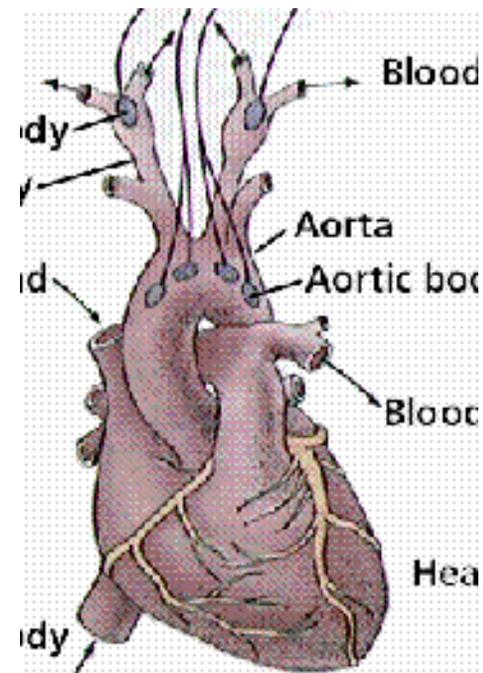
Central Nervous System Control

- ◆ Chemo Receptors

Central



Peripheral



Ventilation Perfusion Ratio

- ◆ Ventilation (V): amount of air that moves in or out of the mouth
- ◆ Minute Ventilation: # of breaths/min X volume of each breath
- ◆ 12 breaths/min x 500ml = 6000 ml (6L)

- ◆ Perfusion (Q): Flow of blood through lungs
 - ◆ lungs are perfused with 6L blood per min

$$\frac{V}{Q} = \frac{6L \text{ Ventilation}}{6L \text{ Perfusion}} = 1$$

V/Q Mismatch

- ◆ **$V/Q < 1$** = decreased ventilation
 - ↓ V = Asthma, COPD, pulmonary edema or any other condition that interferes with the movement of air to the gas exchanging areas of the lungs
- ◆ **$V/Q > 1$** = absence or ↓ ↓ ↓ in perfusion in areas of the lungs
 - ◆ ↓ Q = Pulmonary Embolism, any shock state where the lungs are significantly hypoperfused

V/Q Ratios

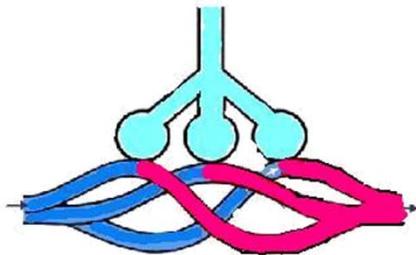
Respiratory Volume
= 6 l/m



Blood Flow
= 6 l/m

$$V/Q = 1$$

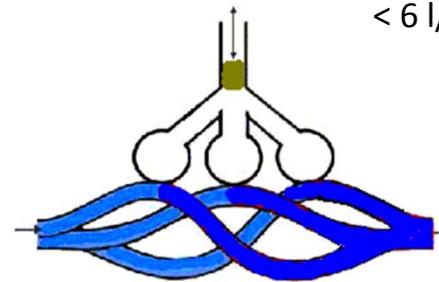
Respiratory Volume
= 6 l/m



Blood Flow
< 6 l/m

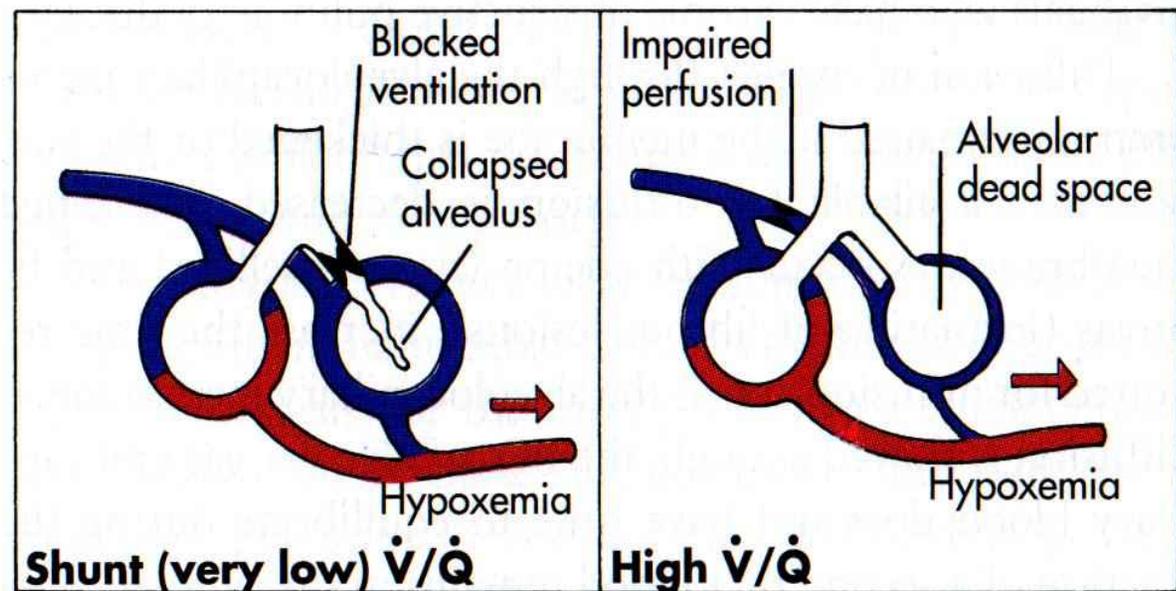
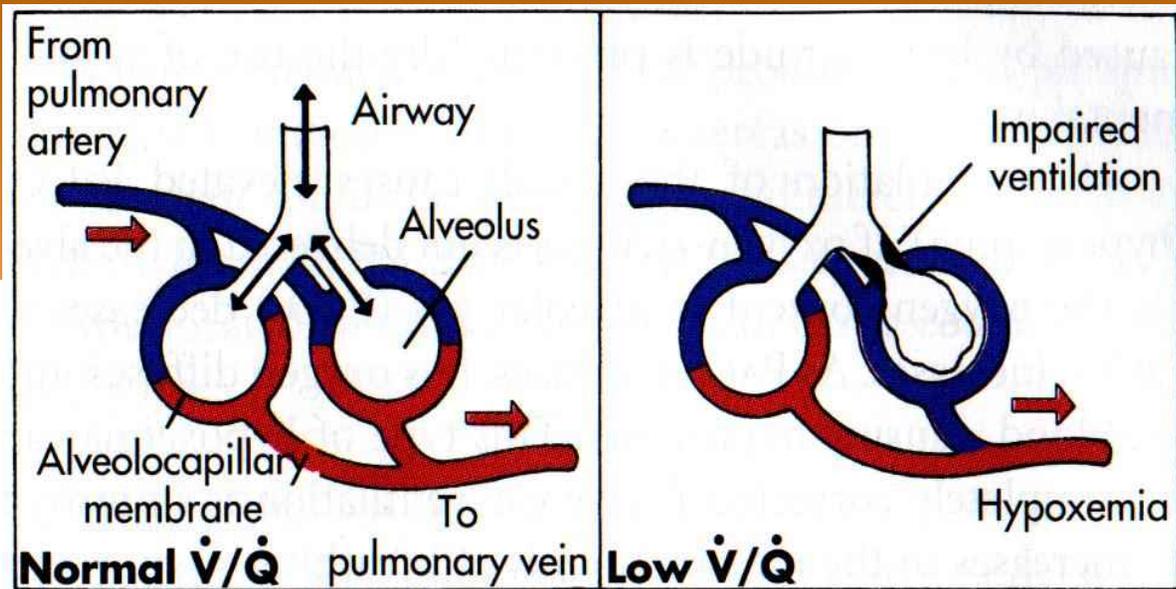
$$V/Q > 1$$

Respiratory Volume
< 6 l/m



Blood Flow
= 6 l/m

$$V/Q < 1$$



Intrapulmonary Shunting

- ◆ Area of lung with decreased ventilation ($V/Q < 1$) will not have fully saturated hemoglobin ex. Hb 75% saturated.
- ◆ This blood will mix with blood that is fully saturated ex. 98%. Mixing of this blood is the shunt
- ◆ Outcome is circulated blood being sat of 88.5 %

Oxygen Transport

- ◆ 1.5 % O₂ Dissolved in blood plasma
- ◆ 98.5 % bound to hemoglobin (Oxyhemoglobin)
- ◆ PaO₂ determines SAO₂
- ◆ Approx 25 % O₂ utilized
- ◆ Each molecule of hemoglobin is fully saturated when 4 iron sites have oxygen molecules. Harder for first to bind than others

Common Respiratory Illnesses

- ◆ Asthma – Disease of the Upper airway, resulting in constriction, which is heard as Wheezing.
- ◆
- ◆ Emphysema – disease process that affects the smaller airways, Bronchioles, Alveoli. ++ mucos production
- ◆ Bronchitis – Recurrent disease process that affects the larger airways.

Hypoxia

Lack of sufficient O_2 to allow proper functioning of the brain and other tissues

Treatment of Hypoxia takes highest precedence in the treatment of any patient

- ◆ 7 Causes

- 1. Decreased FiO_2**

- ◆ Halon Gas (eats O_2)
- ◆ Methane Gas (displaces O_2)
- ◆ Altitude
- ◆ Airway Obstruction

Hypoxia

2. Mechanical

- ◆ Cord Transection
- ◆ C.V.A- Tumor
- ◆ Drug Overdose
- ◆ Flail Chest
- ◆ Pneumothorax

3. Lung Disorders

- ◆ COPD (Emphysema, Chronic Bronchitis)
- ◆ Asthma
- ◆ Lack of Surfactant
- ◆ Pneumonia

Hypoxia

4. Membrane

- ◆ Pathology that thickens membrane e.g. Interstitial Edema

5. Cardiac Output

- ◆ Pathology that decreases cardiac output
- ◆ M.I, Infection, Fast / Slow Heart Rate

6. Hemoglobin

- ◆ Lack of RBC's(anemia)
- ◆ How well it binds with oxygen (carbon monoxide poisoning)

7. Cell

- ◆ Histotoxic Hypoxia (cyanide poisoning)



Well Done!

Ontario Base Hospital Group
Self-directed Education Program