


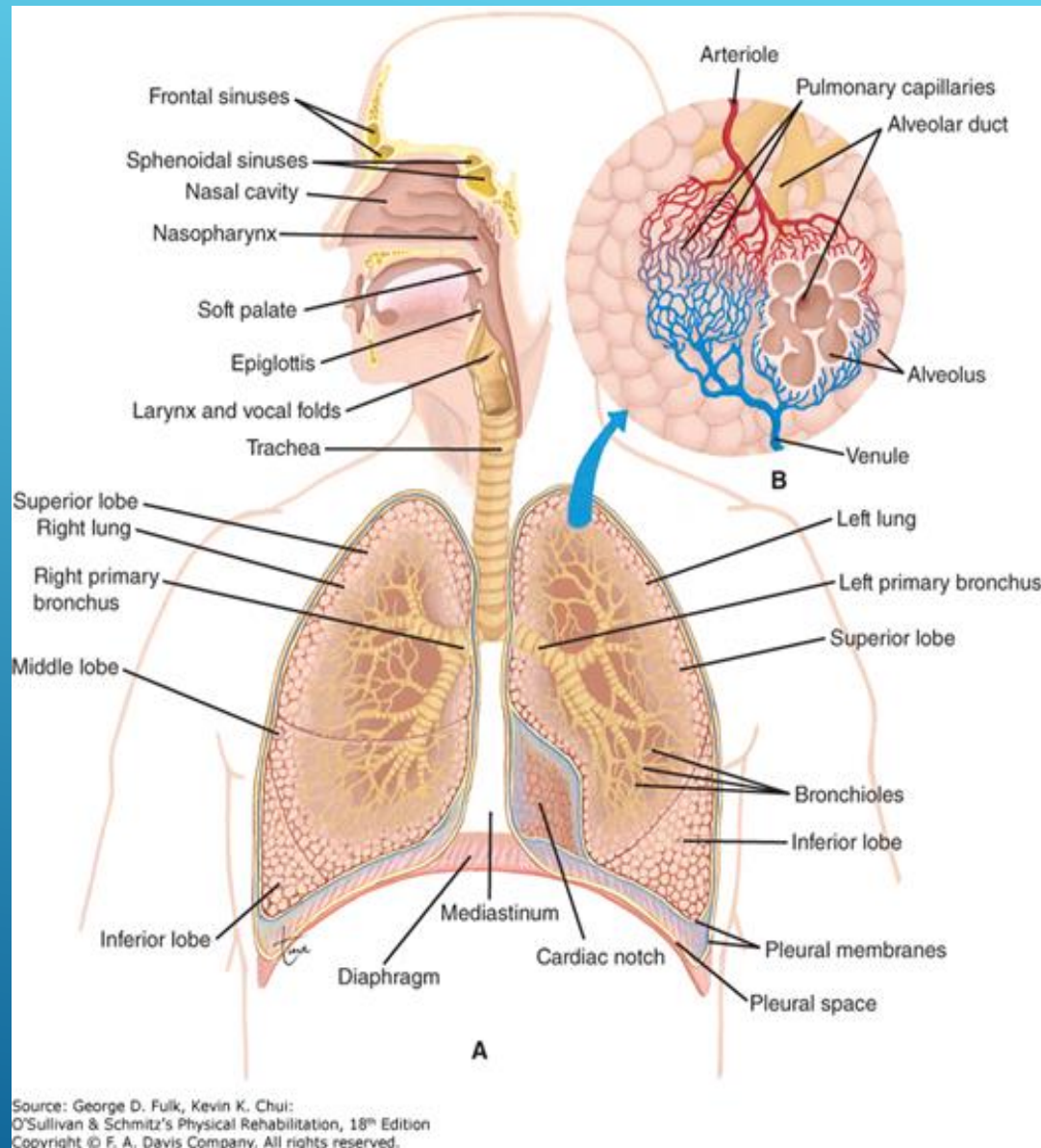
THE RESPIRATORY- VENTILATION SYSTEM

▶ PTA1010



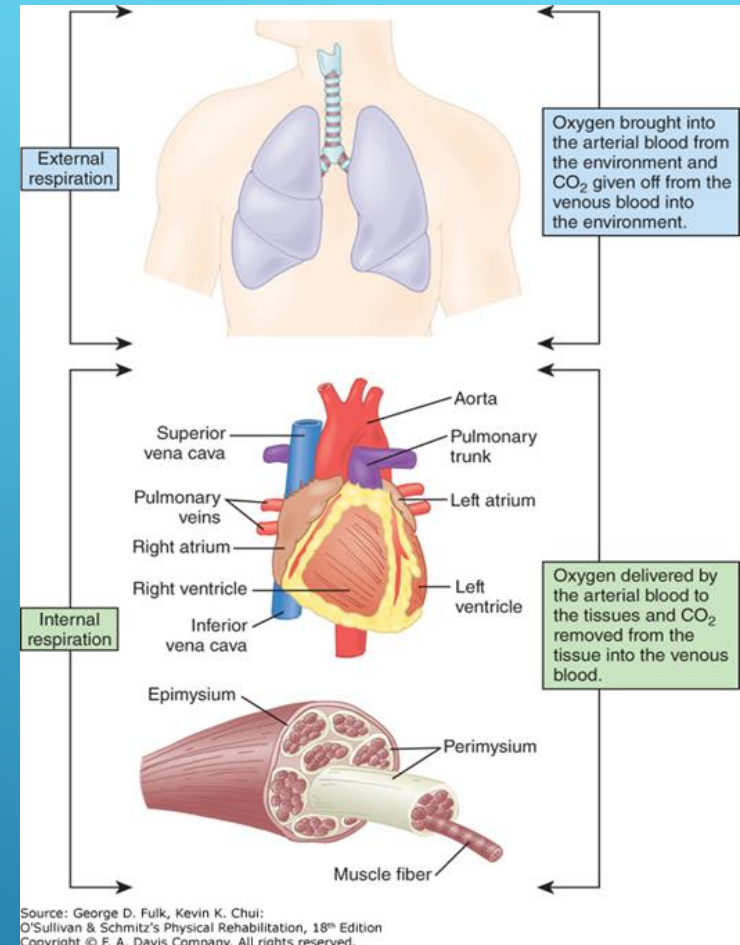
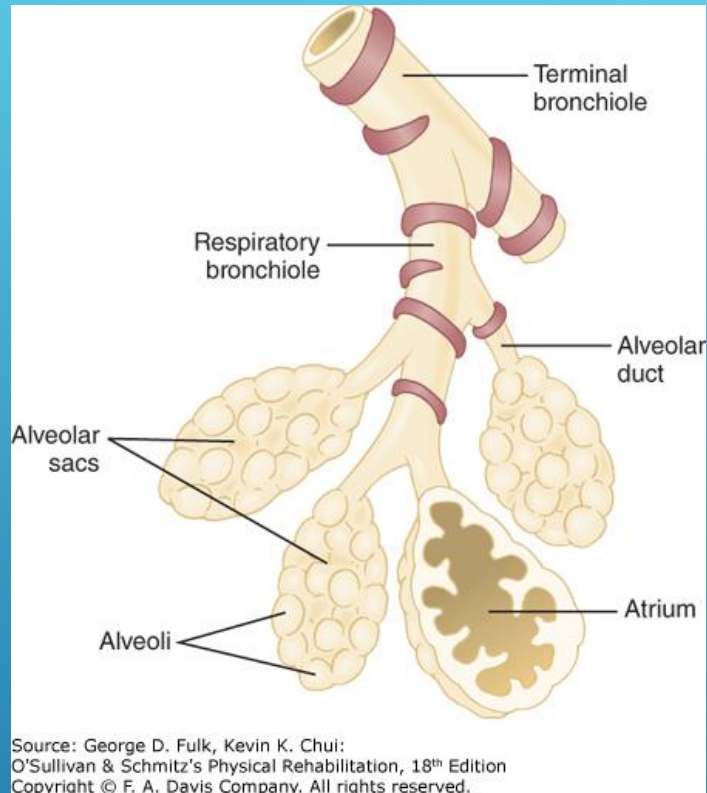
FOLLOWING THE LECTURE THE STUDENT WILL BE ABLE TO:

- ▶ Describe normal anatomy and physiology of ventilation
 - ▶ Discuss the mechanisms of quiet and forced inspiration and expiration including the muscles that contribute to each phase.
 - ▶ Compare chest breathing to diaphragmatic breathing.
 - ▶ Describe normal and abnormal lung volumes and capacities.
- 
- A series of white diagonal lines of varying lengths and thicknesses, located in the bottom right corner of the slide.



STRUCTURES OF THE RESPIRATORY SYSTEM

Source: George D. Fulk, Kevin K. Chui:
O'Sullivan & Schmitz's Physical Rehabilitation, 18th Edition
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OXYGENATION: INTERNAL AND EXTERNAL RESPIRATION

Lab Values and Terms

$\text{PaCO}_2 = 35\text{-}45 \text{ mmHg}$

$\text{PaO}_2 = 80\text{-}100 \text{ mmHg}$

HYPOXEMIA- low level of blood O_2

HYPOXIA- low level of O_2 in tissues

SaO_2 - 95-98%

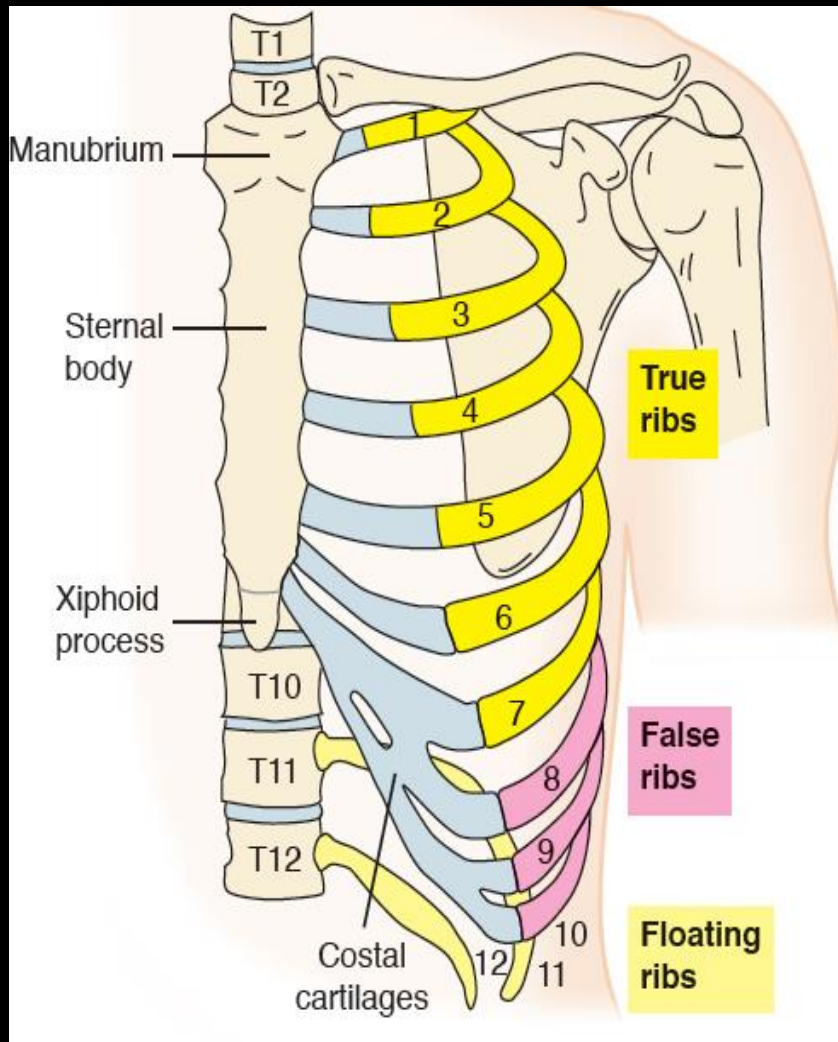
DYSPNEA- shortness of breath

APNEA- absence of breathing

EUPNEA- normal breathing

TACHYPNEA- fast rate: > 20 breaths/min

THORACIC CAGE- PROTECTS LUNG TISSUE



- ▶ True Ribs 1-7
anterior sternal attachment
- ▶ False Ribs 8-10
attach to via cartilage
- ▶ Floating Ribs 11-12
no anterior attachment

MECHANICS OF RESPIRATION

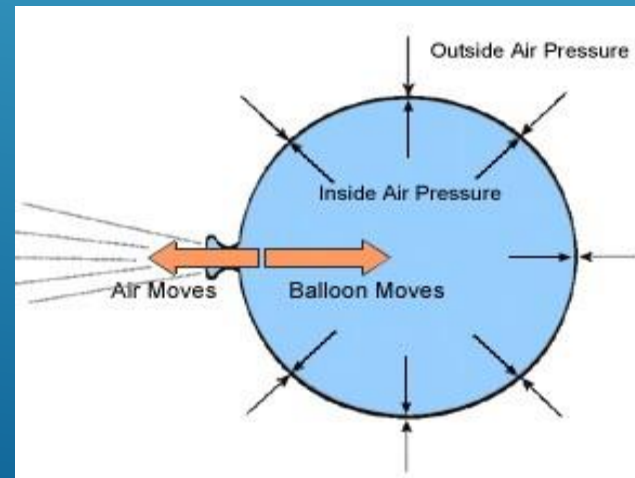
AIR FLOWS FROM A HIGHER PRESSURE TO LOWER PRESSURE UNTIL PRESSURE IS EQUALIZED.

Inspiration: Active muscle contraction

As lung space increases in size the atmospheric pressure within the lungs decreases- **air enters**

Expiration: Passive/relaxation of muscles

Lung space is reduced therefore increasing lung atmospheric pressure- **air exits**



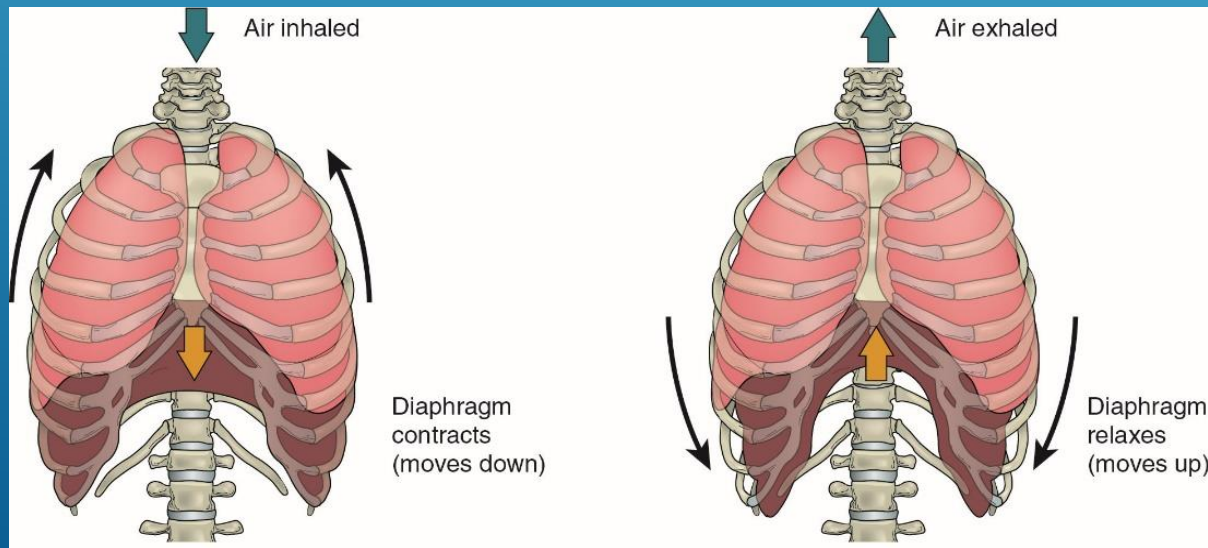
QUIET RESPIRATION: TIDAL VOLUME

Primary Ventilatory Muscles: diaphragm, external intercostals

Mechanics: Space Increased as:

Diaphragm Contracts increases superior/inferior space

External Intercostals Contract— ↑ med/lateral (**bucket handle**)
↑ ant/post (**pump handle**)



MUSCLES/MECHANICS - DIAPHRAGM & INTERCOSTALS

Diaphragm- phrenic nerve C3-C5

Performs **60%-80%** during ventilation

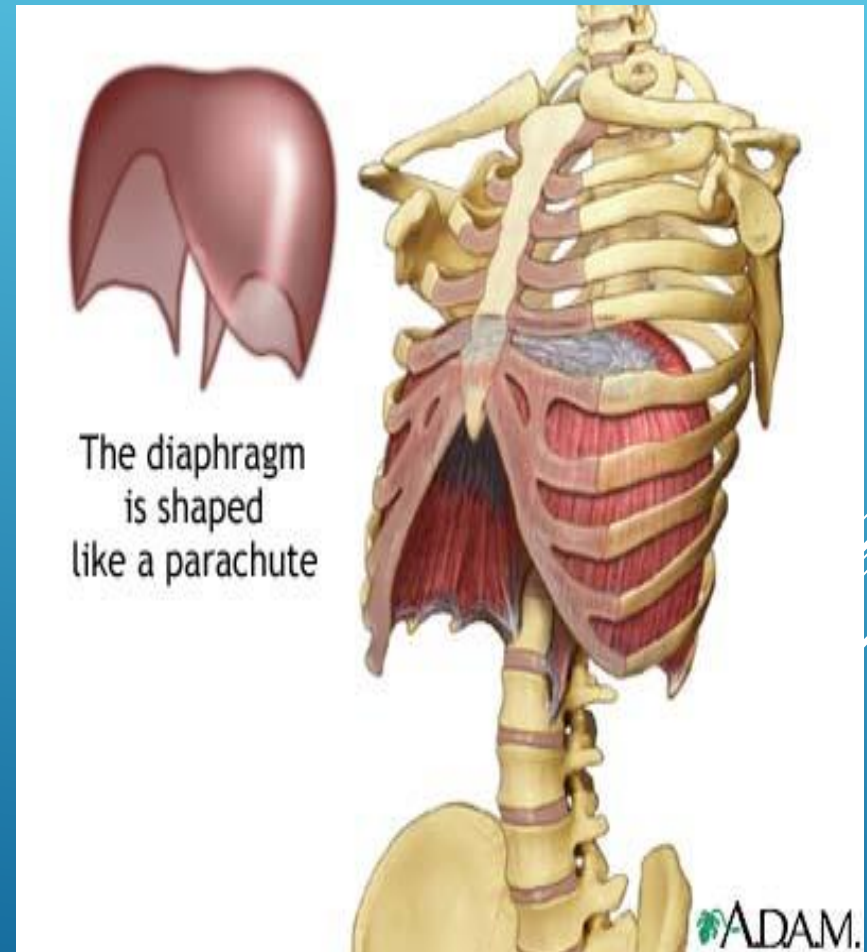
Inhalation: contracts (dome down)

Exhalation: relaxes (dome moves up)

Internal and External Intercostals

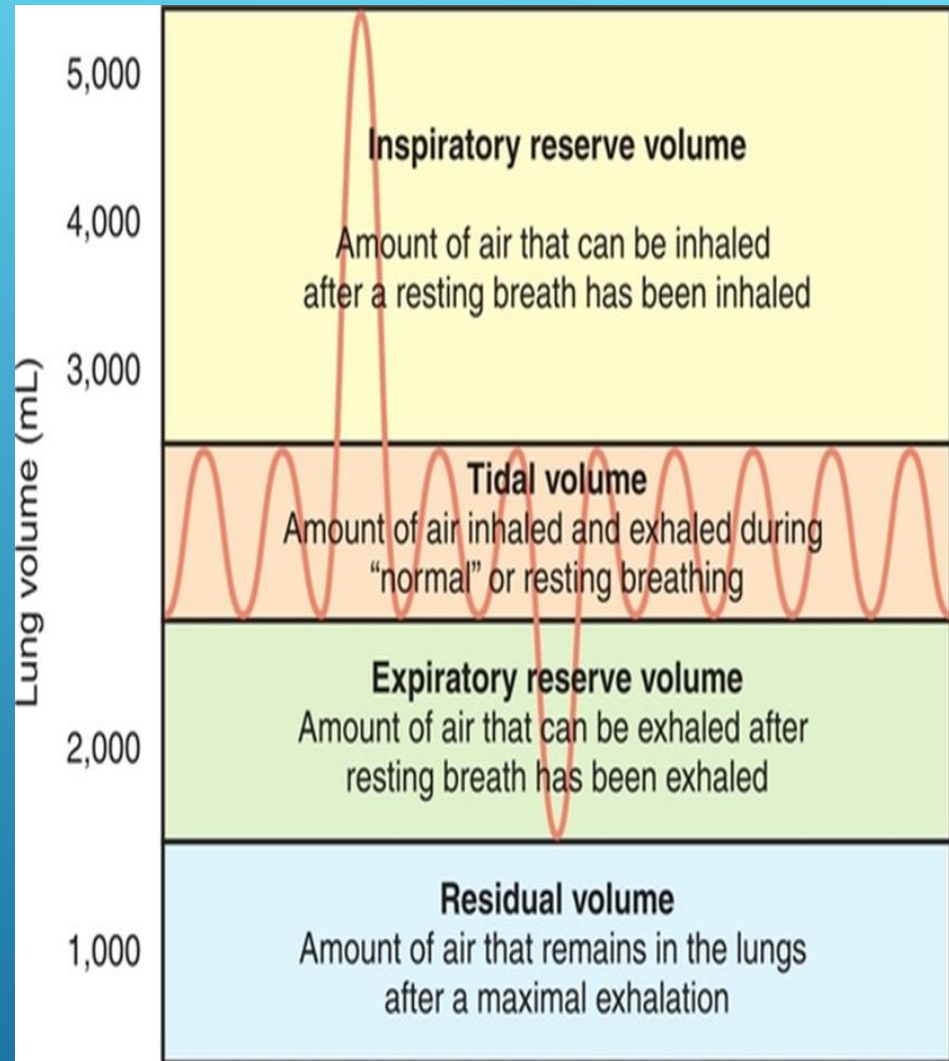
Inhalation: Pull lower rib up and out (primarily Externals)

Exhalation: Pull upper rib down (internals)



LUNG VOLUMES

- ▶ **TOTAL LUNG CAPACITY=**
- ▶ **Tidal volume**
- ▶ **Inspiratory reserve volume**
- ▶ **Expiratory reserve volume**
- ▶ **Residual volume**

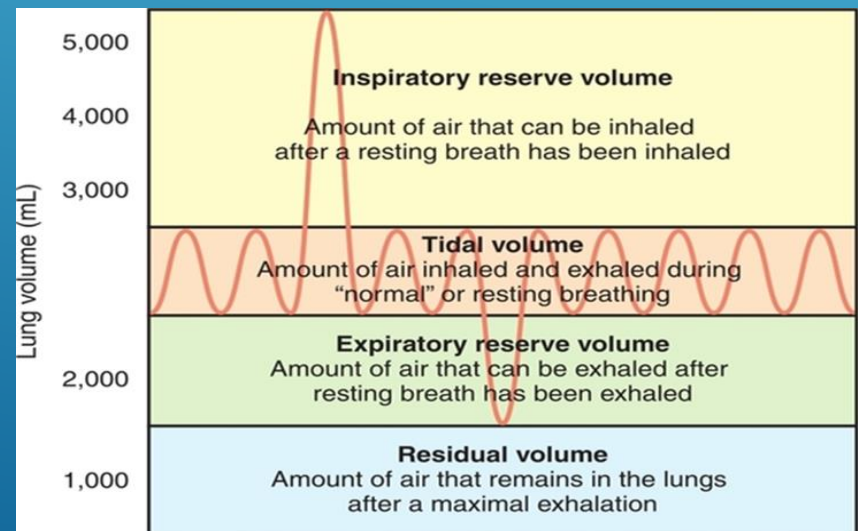
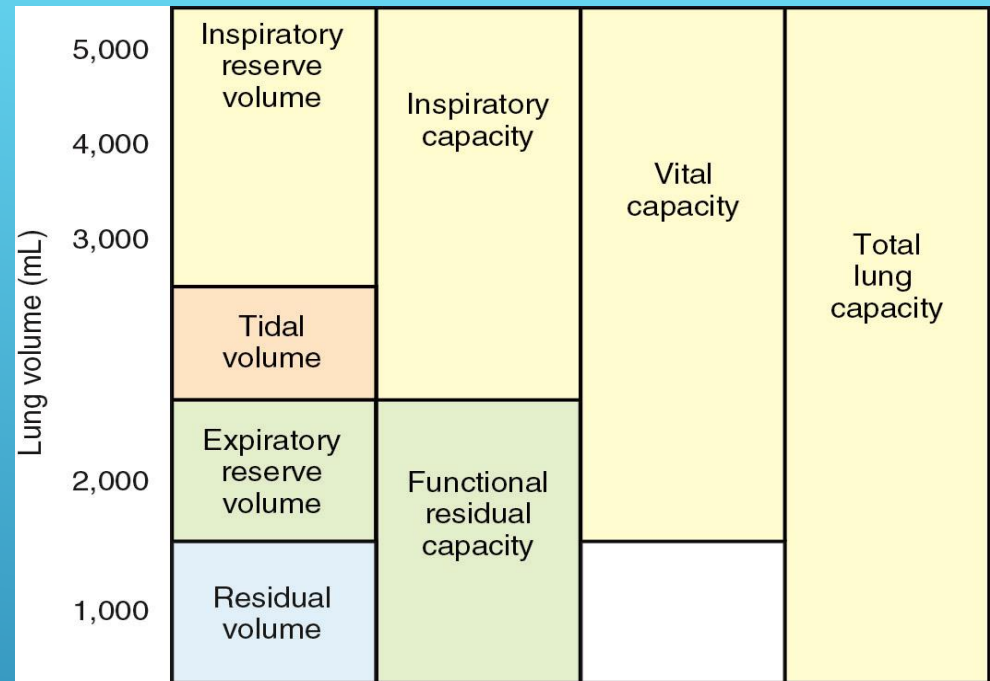


► **IRV+ TV+ ERV = vital capacity**

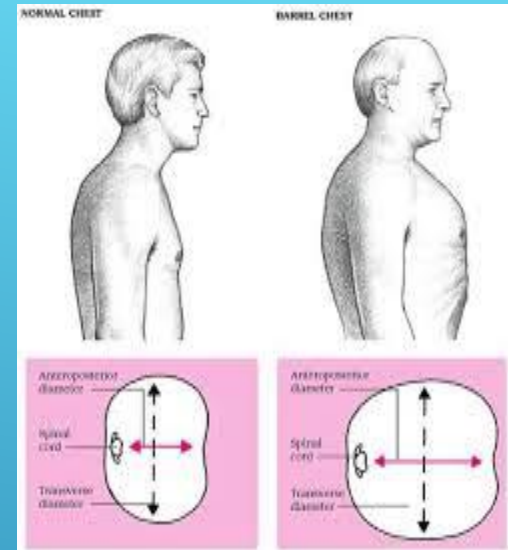
► **RV** is air that remains in the lungs to keep them inflated

► **Total Lung capacity = IRV+ TV+ ERV+RV**

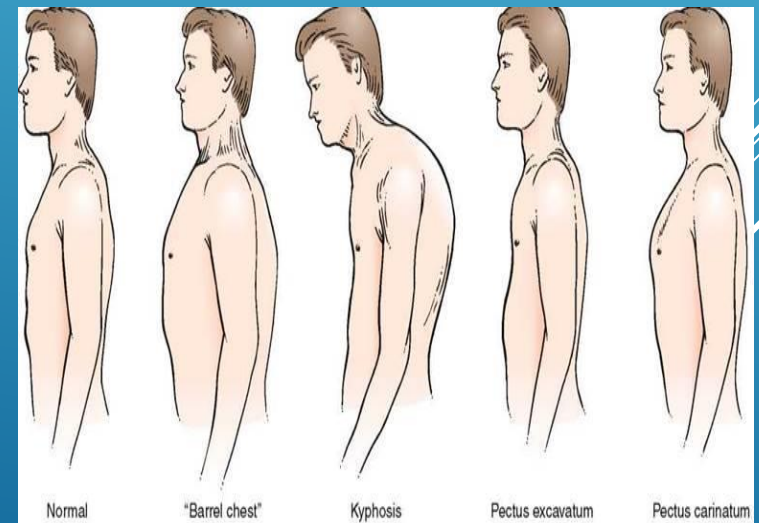
LUNG CAPACITIES



- ▶ Respiratory Rate
- ▶ Breathing patterns
- ▶ Chest Size/diameter/recoil
- ▶ Posture
- ▶ Skin/lip color
- ▶ Cough
- ▶ Normal or Adventitious breath sounds



OBSERVATION



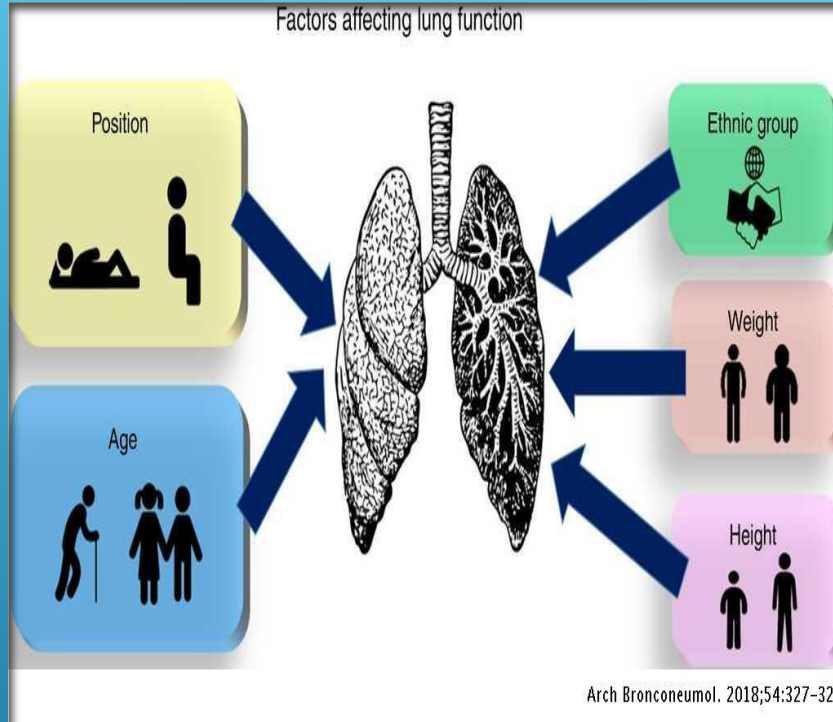
DIAPHRAGMATIC VERSUS CHEST BREATHING

Diaphragmatic

- ▶ Most Efficient
- ▶ Requires least amount of energy

Chest Breathing

- ▶ Requires Marked Effort
 - ▶ Increased Energy
 - ▶ Decreased Volume
 - ▶ Increased Rate
- 



- ▶ Decrease in chest wall compliance and mobility
- ▶ Decrease in recoil ability of lung tissues
- ▶ Changes in spinal curves that influence volumes
- ▶ Increase in work required for breathing
- ▶ Constant tidal volume
- ▶ Decrease in lung vital capacity
- ▶ Increase in residual volumes
- ▶ Decrease in gas exchange between lungs and circulatory system

VENTILATION CHANGES RELATED TO **AGE**

VALSALVA'S MANEUVER: SEQUENCE OF EVENTS

Occurs when patient holds their breath and attempt to exhale.

Sequence:

- ▶ Holding Prolonged breath= \uparrow intrathoracic pressure **trapping blood in veins**
- ▶ **Blood is prevented from entering heart due to pressure.**
- ▶ **Reflex Bradycardia** occurs = slowing of heart or fainting or cardiac Arrest.
Depending on health issues of patient.

IMPORTANT: Prevent breath holding when exercising.

Teach pursed lip breathing.

▶

CLINICAL
IMPLICATIONS:

COMPROMISED
LUNG FUNCTION
AND ACTIVITY
TOLERANCE

Spinal Scoliosis and kyphosis: malalignment affects the posterior ribs and its mechanics= **decrease lung volumes.**

Forward Head, round shoulder posture: **flexion limiting expansion** between ribs reducing intake volume of air.

Arthritis and joint degeneration: reduced motion impairs rib elevation/depression.

Pneumonia: inflammation of the alveoli by bacteria/viral infection.

Bronchial Emphysema: alveoli distended= loss of elasticity.