



# Assessment of respiratory system

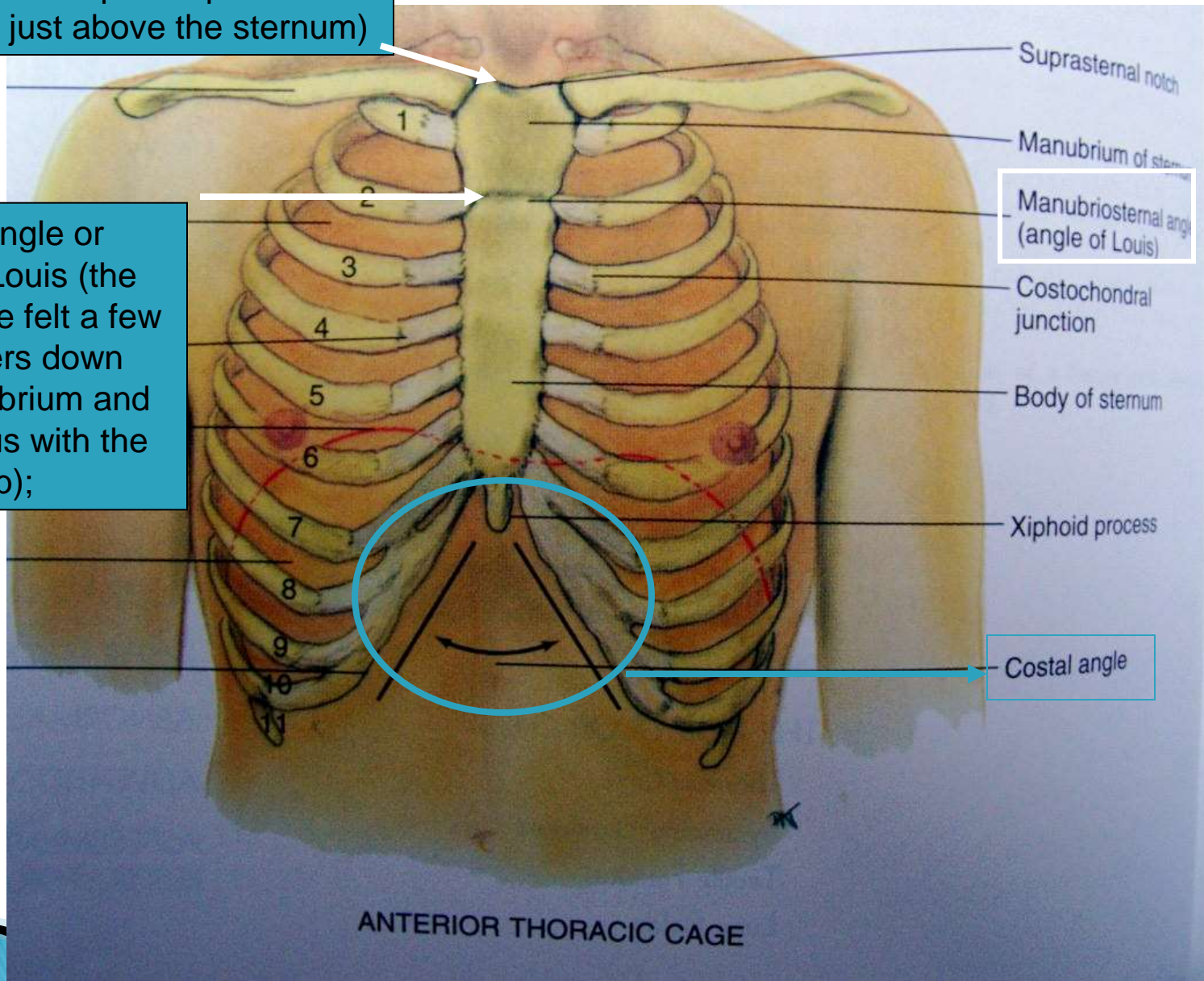
NUR 206 – Fall 2015

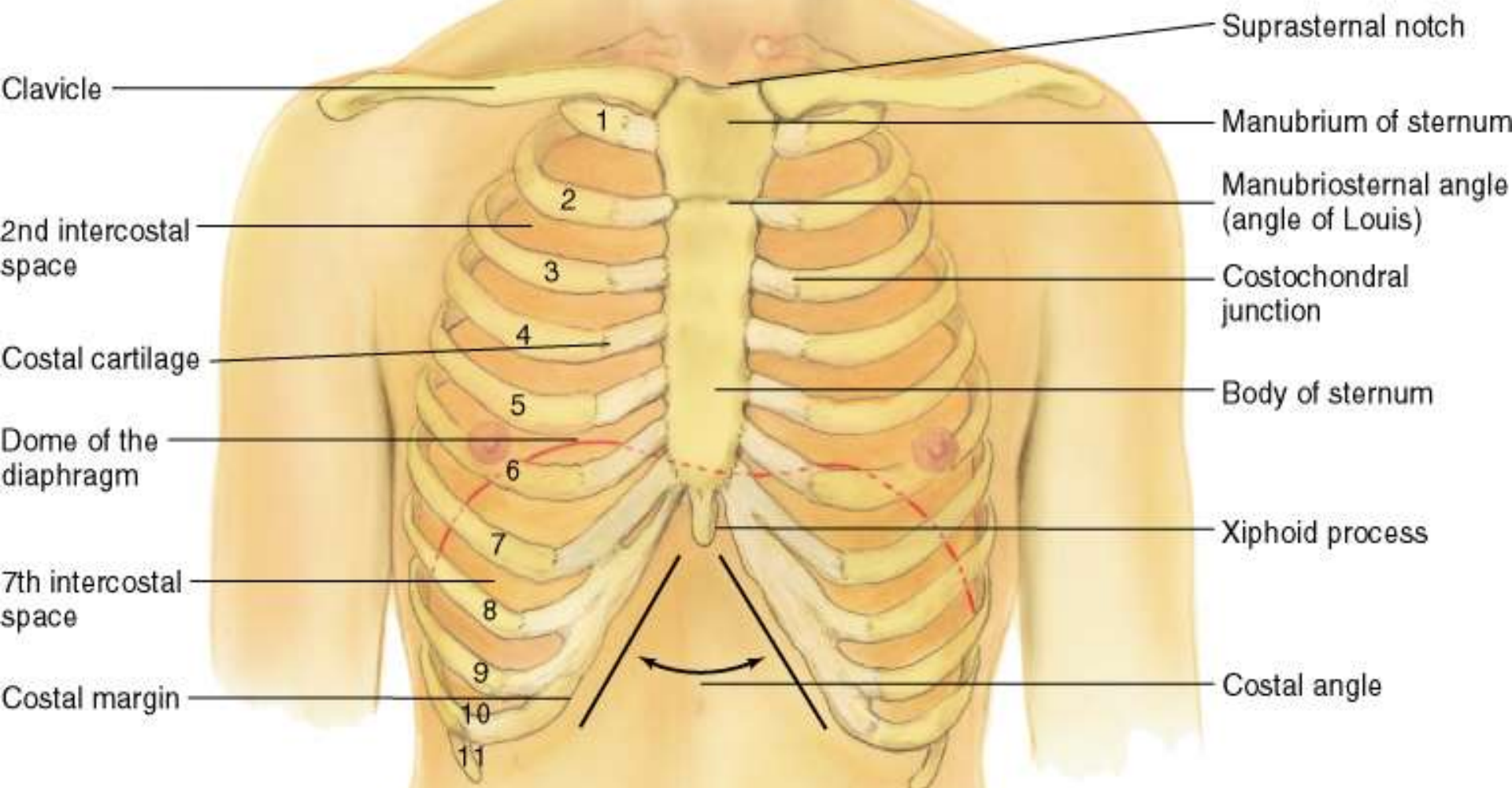
# Anterior Thoracic Landmarks

- ▶ **Suprasternal Notch** – U shaped depression
- ▶ **Sternum** “breastbone”: 3 parts :
  1. Manubrium
  2. Body
  3. Xiphoid process
- ▶ **Sternal Angel** (Angle of Louis) – continuous with the 2<sup>nd</sup> Rib , (mark the site of tracheal bifurcation) .
- ▶ **Costal angle**- usually 90<sup>0</sup> or <. (increases when rib cage is chronically overinflated as in emphysema) .

suprasternal notch (a U-shaped depression just above the sternum)

Sternal angle or angle of Louis (the bony ridge felt a few centimeters down the manubrium and continuous with the second rib);

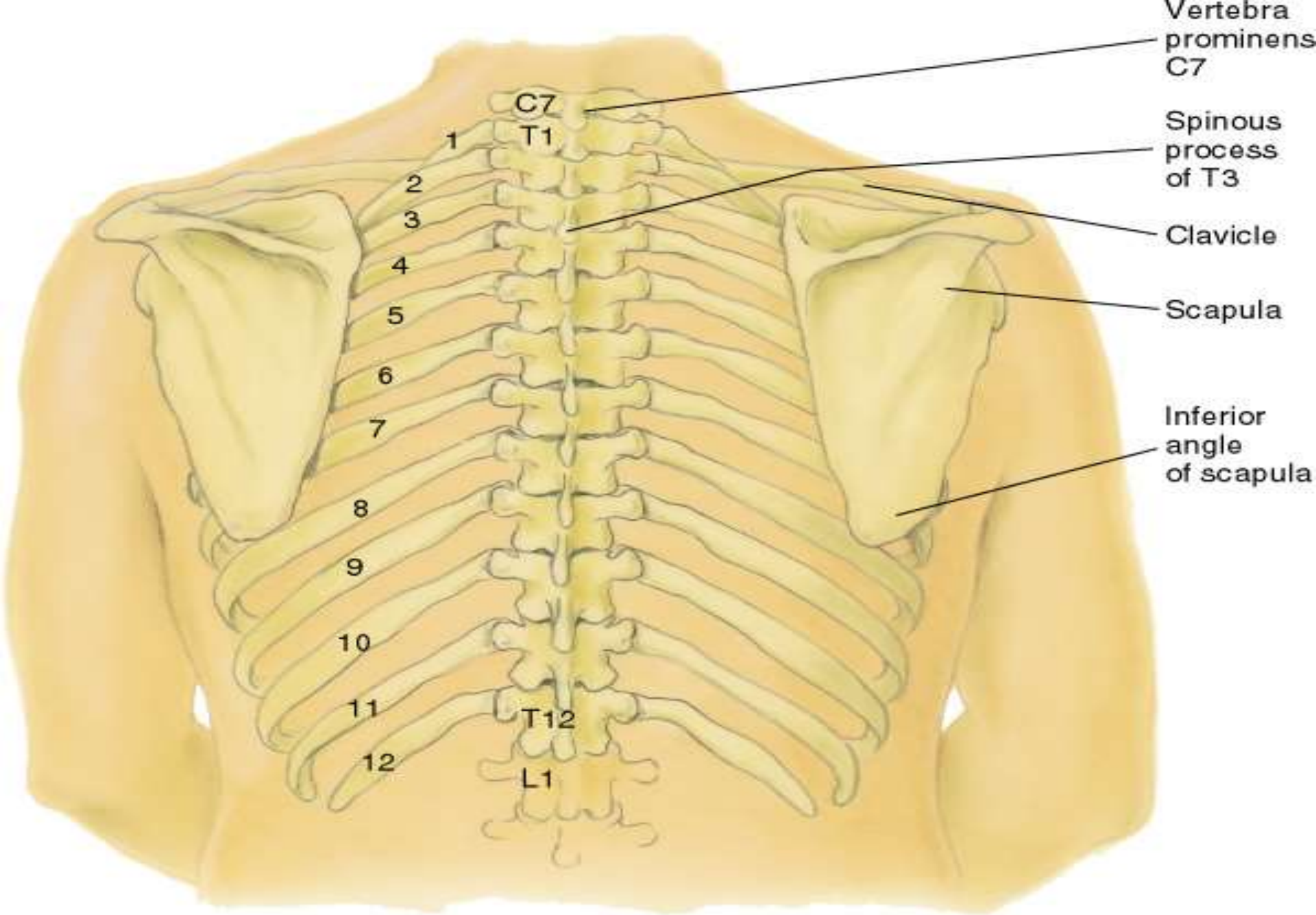




# Posterior Thoracic Landmarks

## LANDMARKS:

- ▶ **Vertebra Prominence** :- most prominent bony projection at base of neck (**C7**) , **next lower one is T1** .
- ▶ **Spinous Processes** :- stacks together to form the spinal column.
- ▶ **Inferior Border of the Scapula** – lower tip **at the 7 - 8<sup>th</sup> Rib** .
- ▶ **12<sup>th</sup> Rib** = it's free tip is located midway between spine & side .



# Reference Lines

## ▶ Anterior Chest :

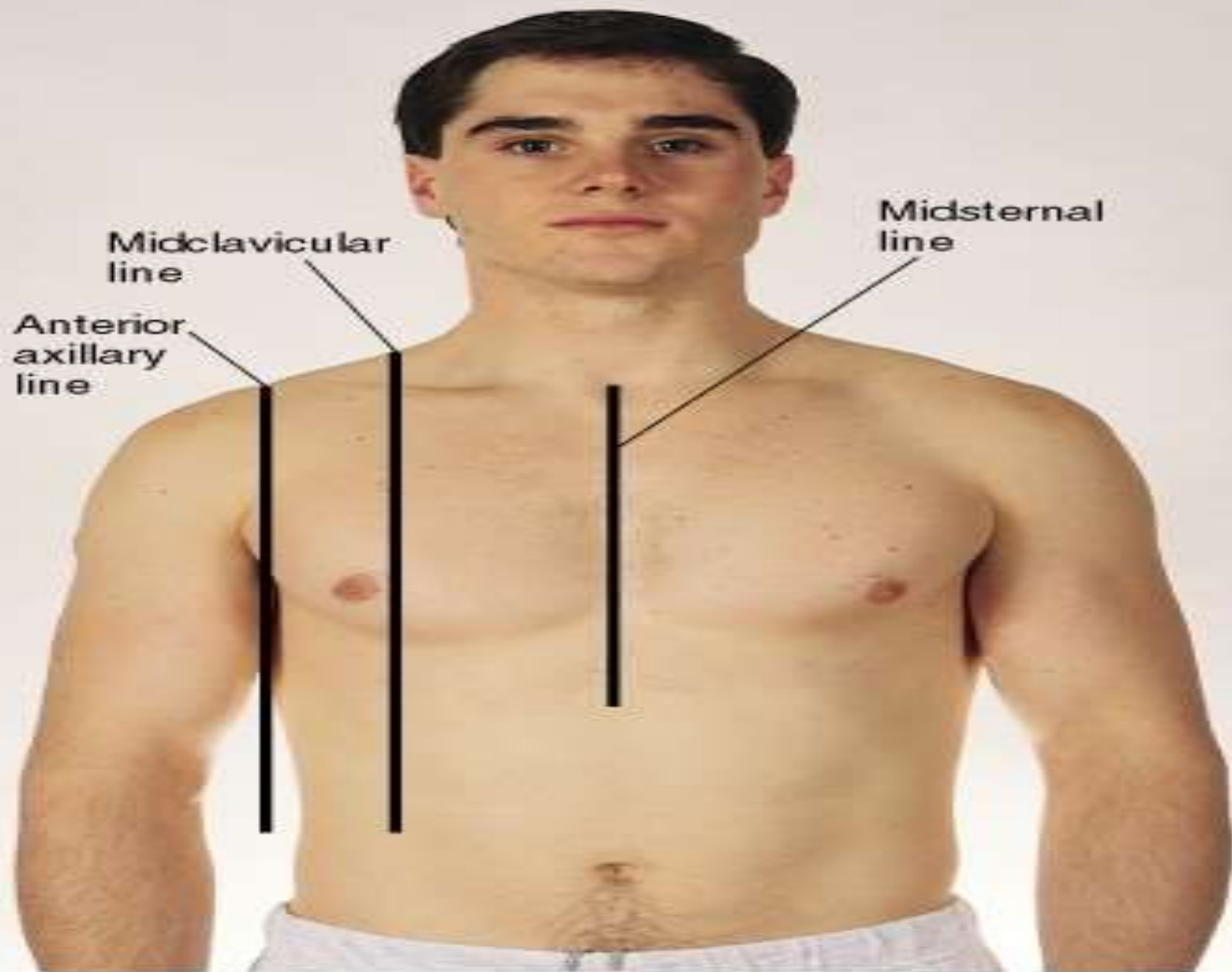
- **Midsternal line** .
- **Midclavicular line** .

## ▶ Posterior Chest :

- **Vertebral line** – (midspinal) .
- **Scapular line** (pass through the inferior angle of the scapula) .

## ▶ Lateral Chest :

- **Anterior Axillary line** .
- **Posterior Axillary line** .
- **Mid-axillary line** (from the apex of the axilla and parallel to the other two lines) .

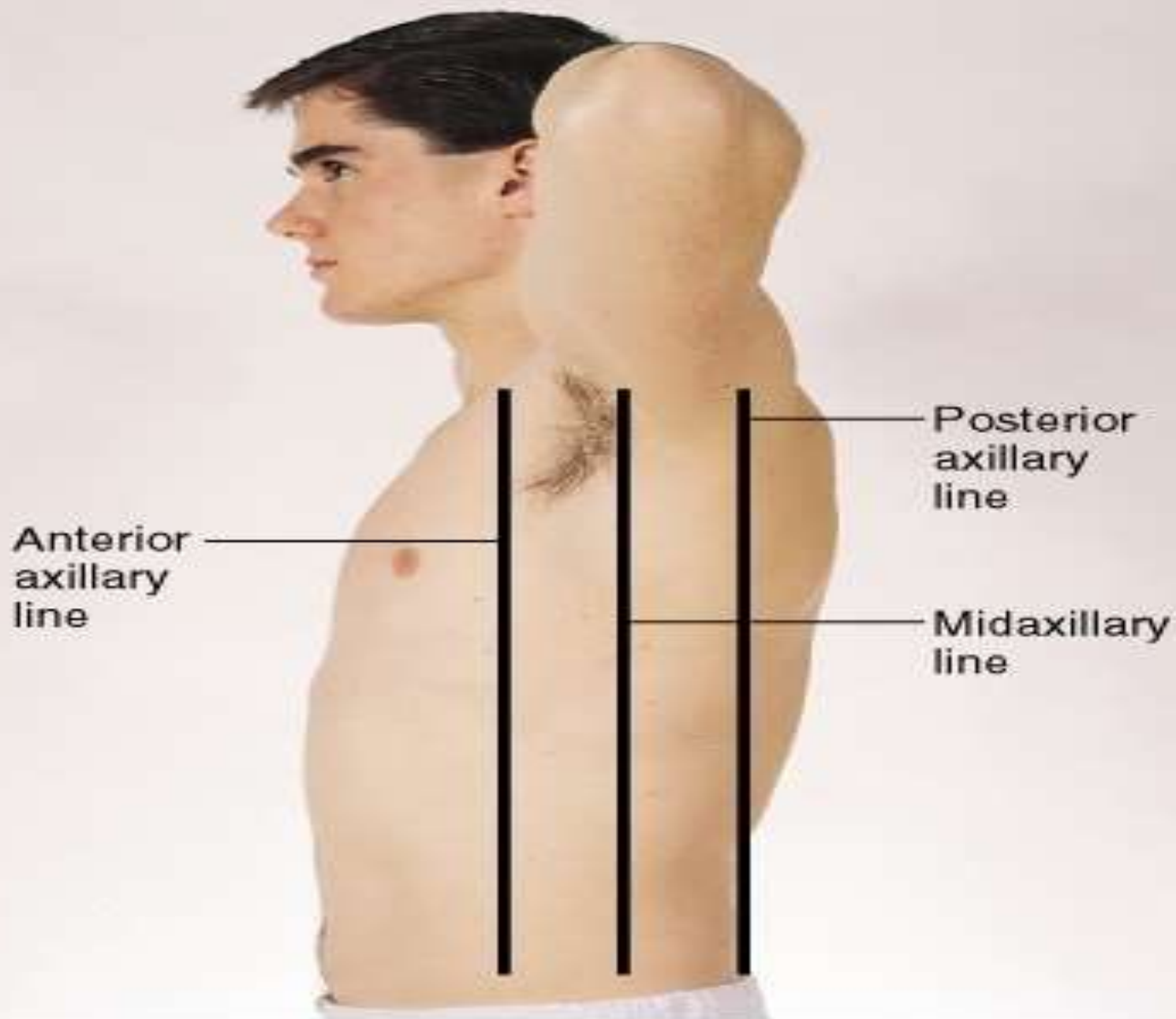




Scapular  
line

Vertebral  
line





# THE THORACIC CAVITY

## Mediasternum and Pleural cavities

### Lung Borders

#### ▶ Anterior Chest :—

- **Apex** 2 - 4 cm above the inner third of the clavicles .
- **Base** – rests on the diaphragm, **6<sup>th</sup> rib**, MCL

#### ▶ Posteriorly :

- **Apex** of lung is at C7
- Base T10 (it extends to T12 with deep inspiration)

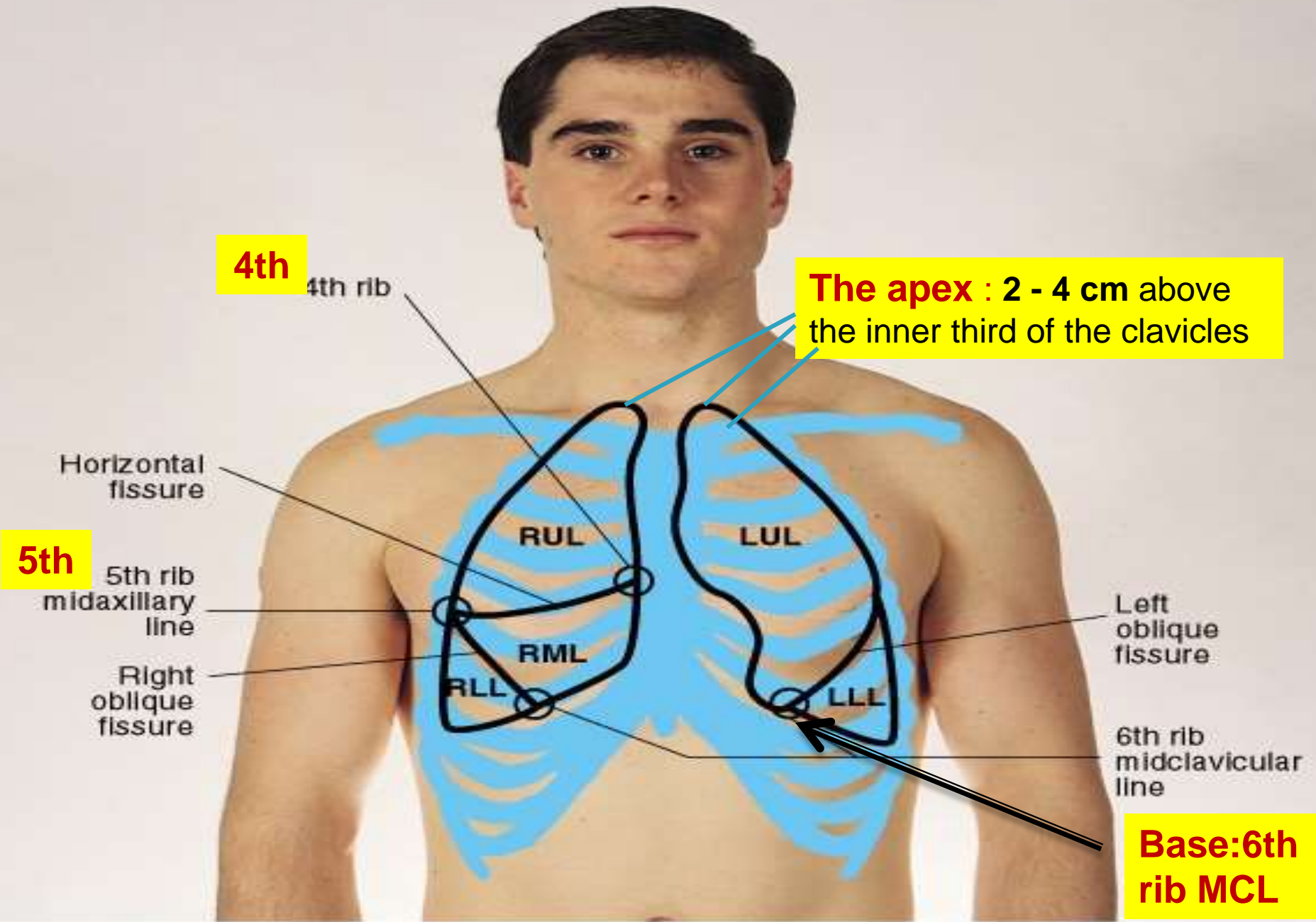
#### ▶ Lateral Chest :

- Extends from **Axilla apex to 7<sup>th</sup> –8<sup>th</sup> rib**

▶ .

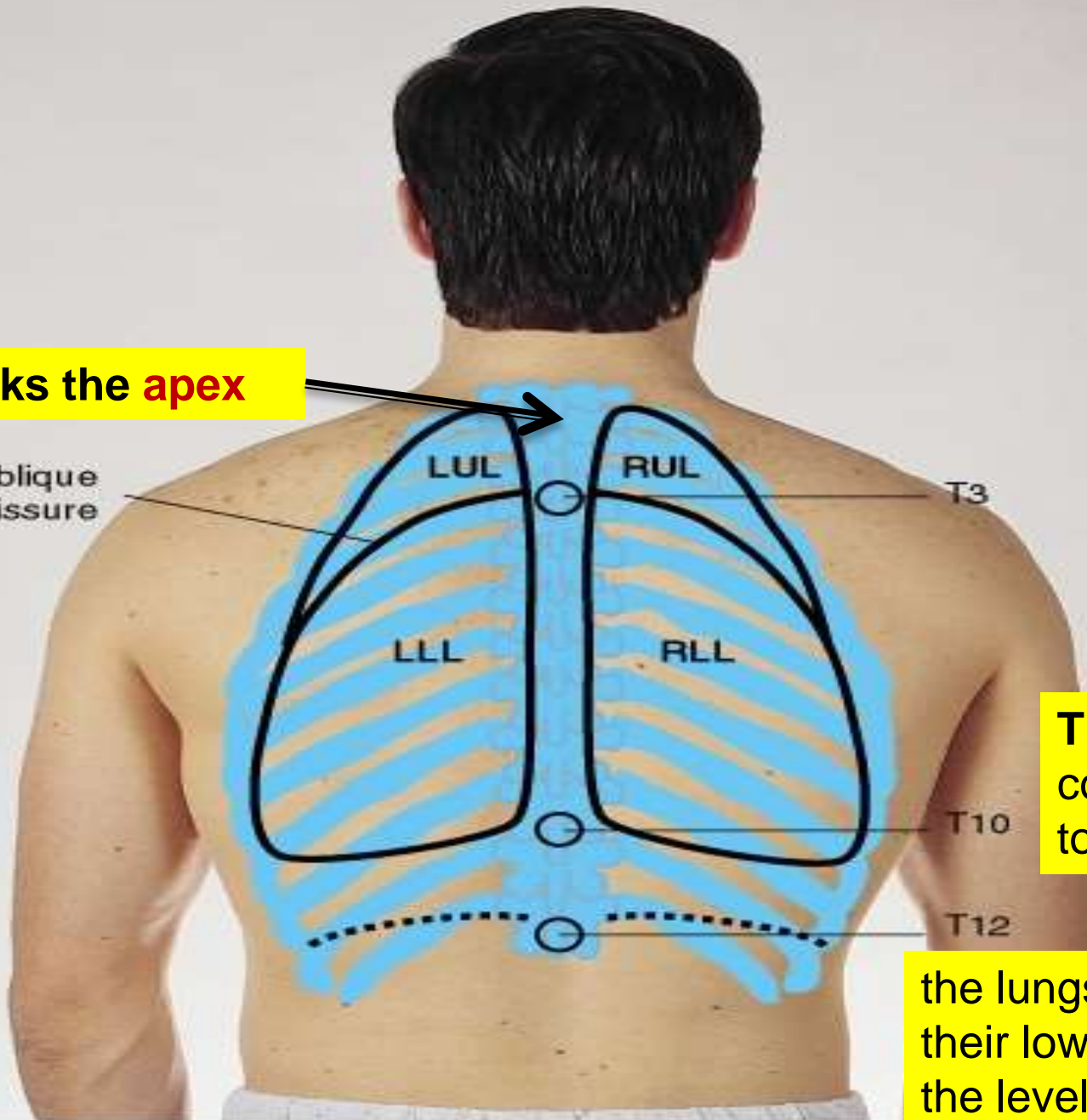
# Lobes of Lung

- ▶ Right Lung :
  - 3 lobes : upper, middle & lower
  - Shorter due to the presence of liver .
- ▶ Left Lung :
  - Left Upper and Lower ( 2 lobes)
  - Narrower due to heart .



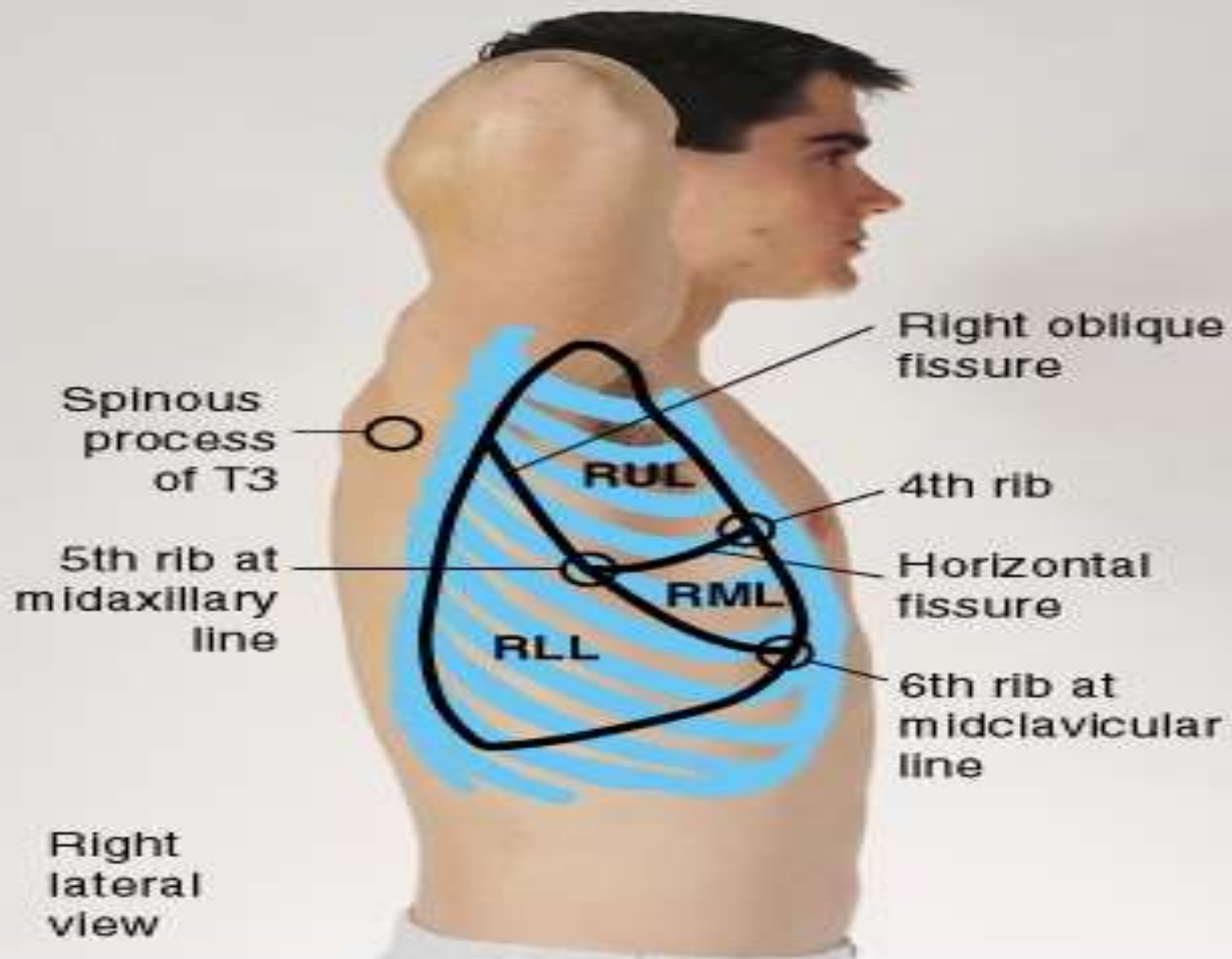
**C7 marks the apex**

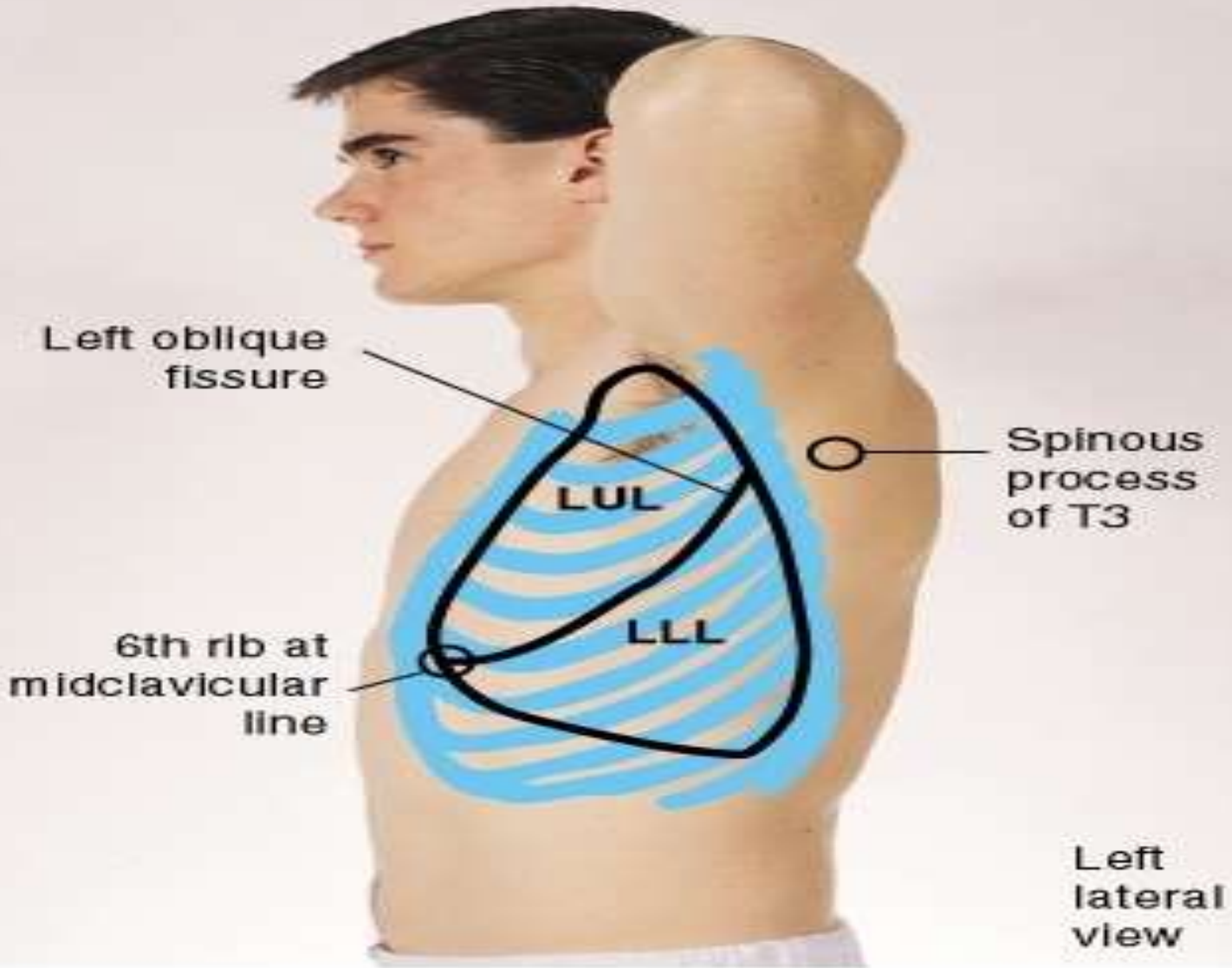
Oblique fissure



**T10** usually corresponds to **the base**

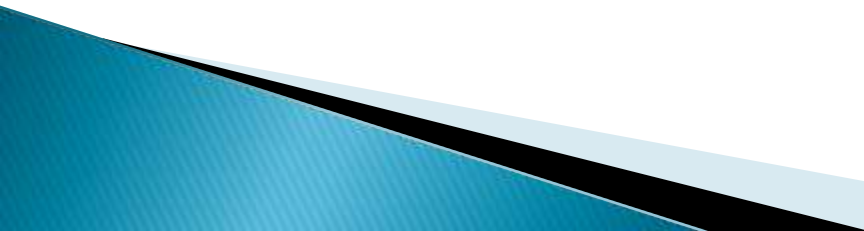
the lungs **expand** their lower border to the level of **T12**.







# Locations on the chest

- ▶ Supraclavicular: above the clavicles
  - ▶ Infraclavicular: below the clavicles
  - ▶ Interscapular: between the scapulae
  - ▶ Infrascapular: below the scapulae
  
  - ▶ Bases of the lungs: the lowermost portions
  
  - ▶ Upper, middle & lower lung fields
- 

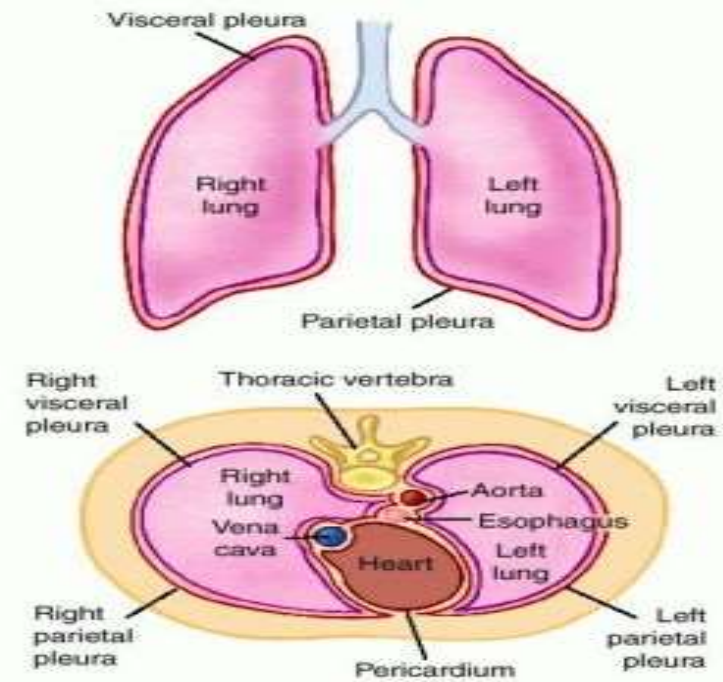
# Pleurae

The thin, serous membrane that cover the outer surface of each lung (envelope between the lungs & chest wall)

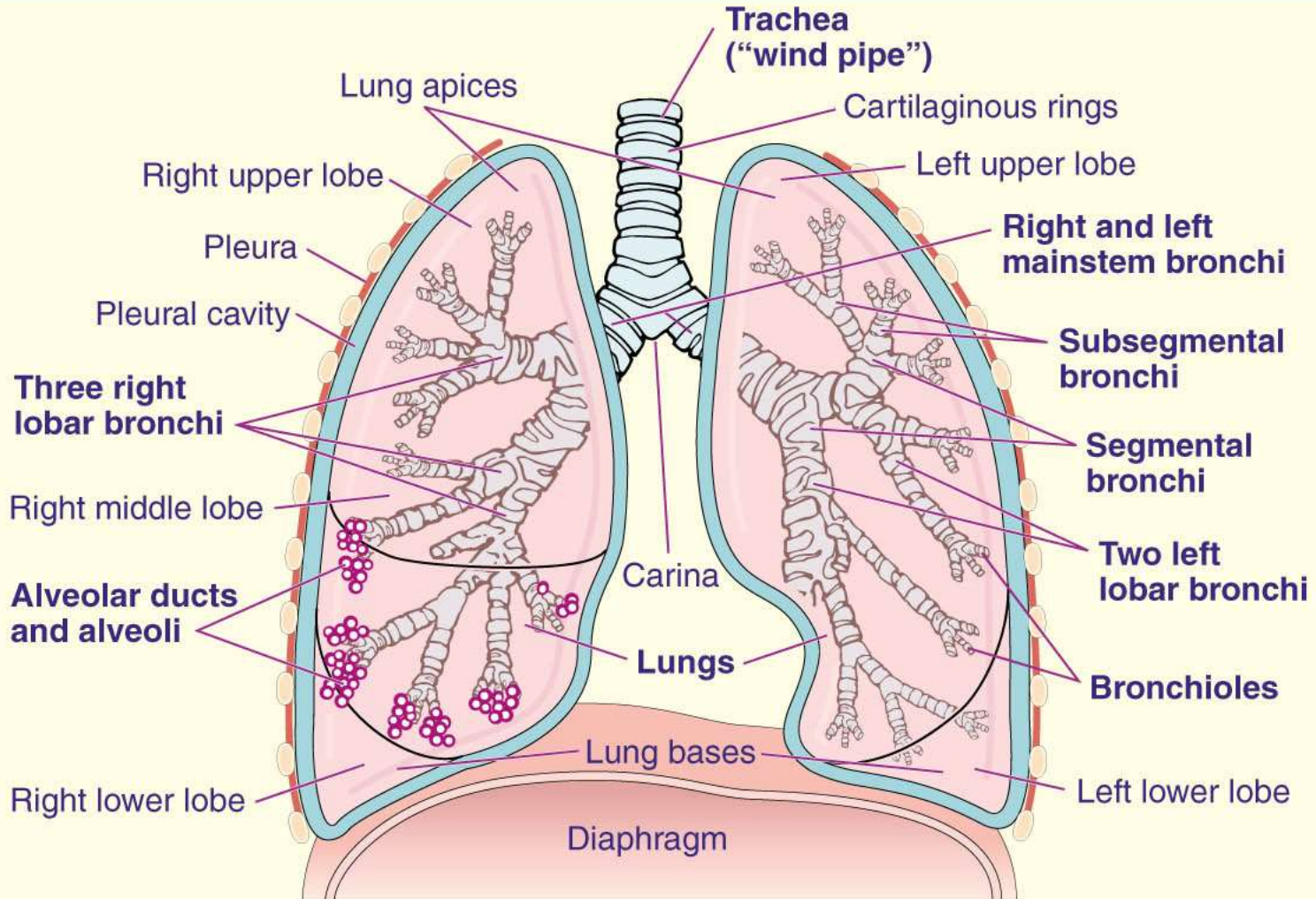
## Two Layers

- ▶ **Visceral pleura:** attached to lungs, line the inner rib cage & upper surface of the diaphragm.
- ▶ **Parietal pleura** lining the inside of the chest wall & diaphragm

**The pleural cavity:** filled with lubricating fluid. It normally has a **negative pressure**, allow the lungs **to move easily** within the rib cage during inspiration & expiration

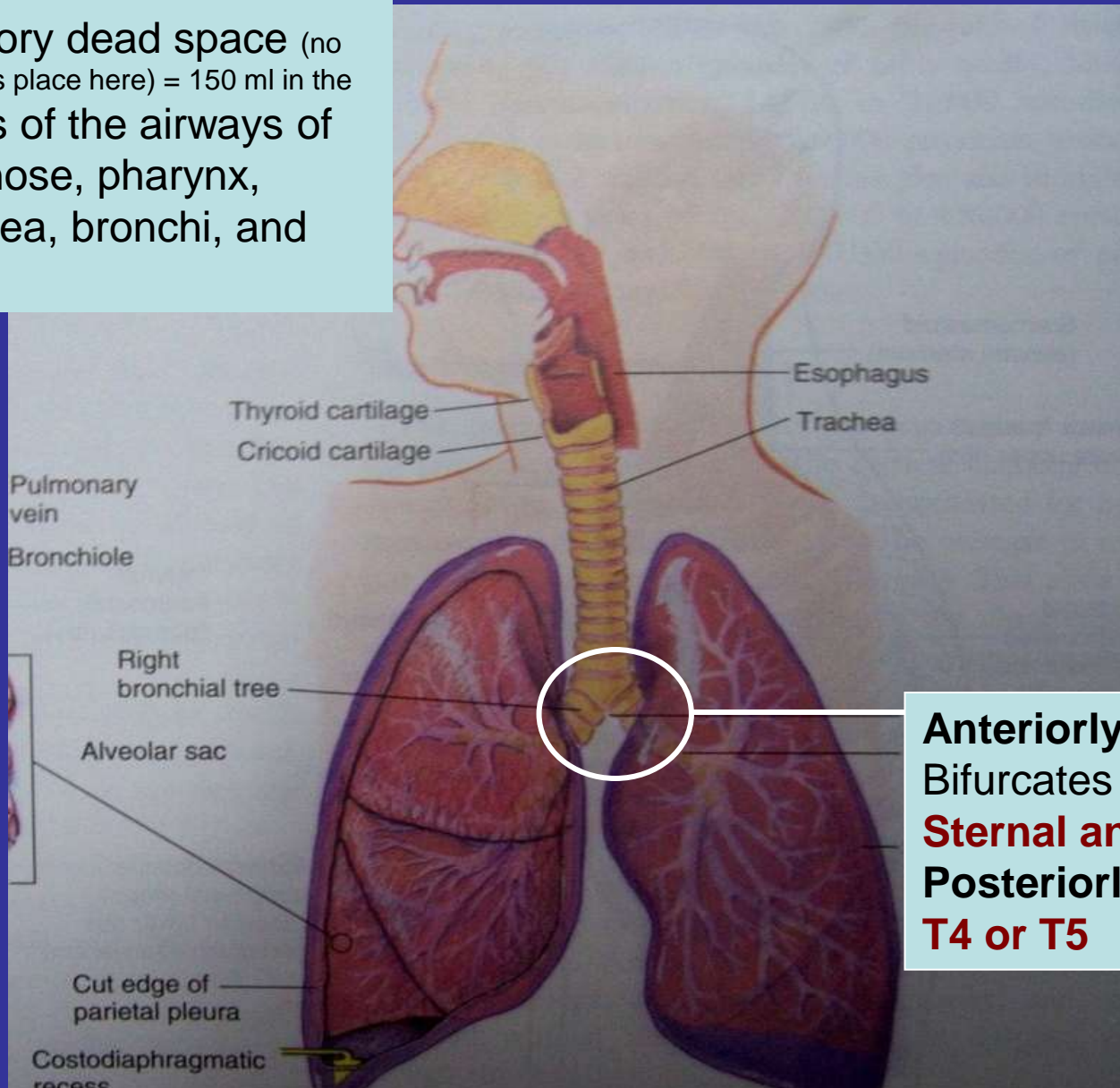


# Lower Respiratory Tract



Modified from Chabner, 2000

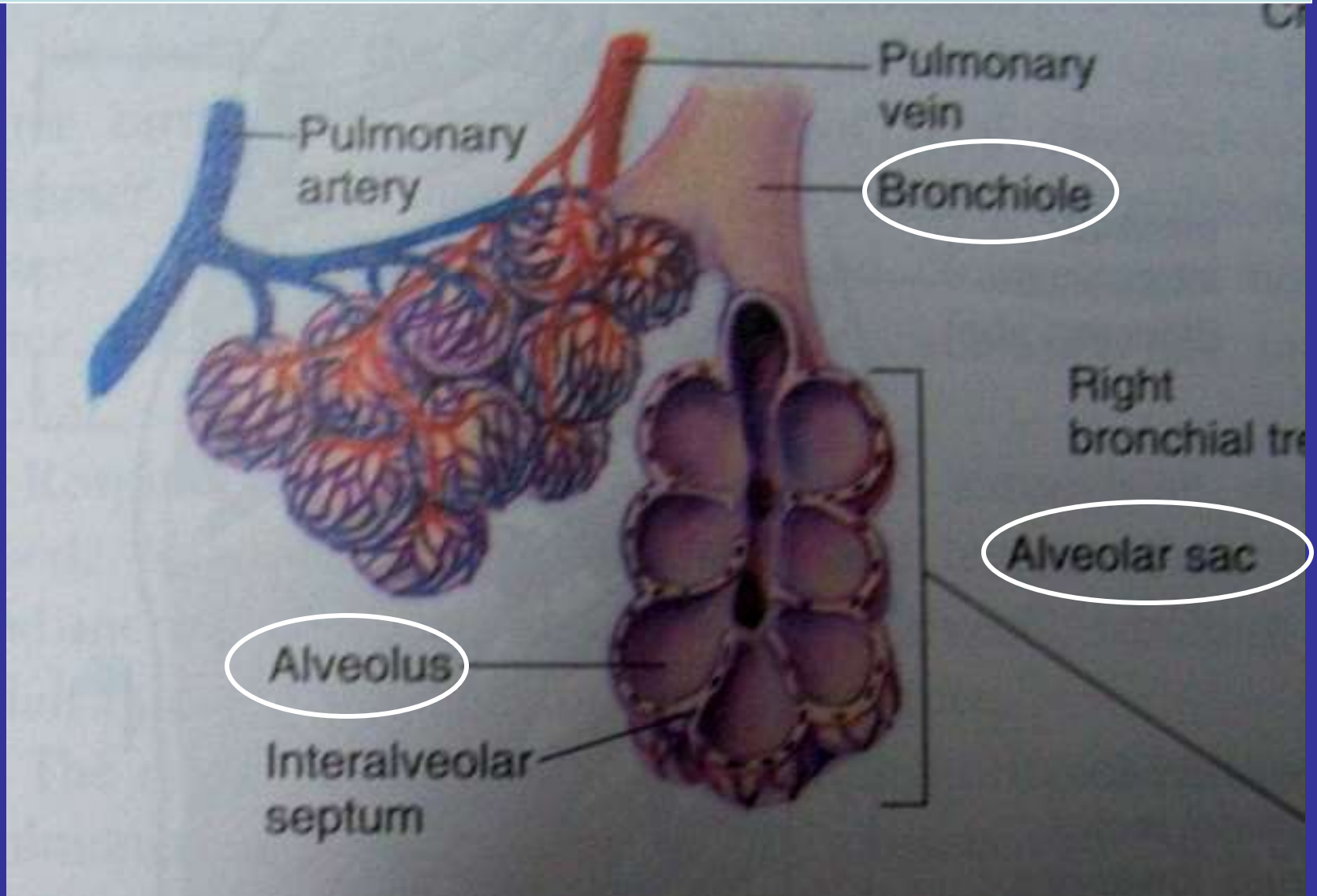
The respiratory dead space (no air exchange takes place here) = 150 ml in the adult) consists of the airways of the mouth, nose, pharynx, larynx, trachea, bronchi, and bronchioles.



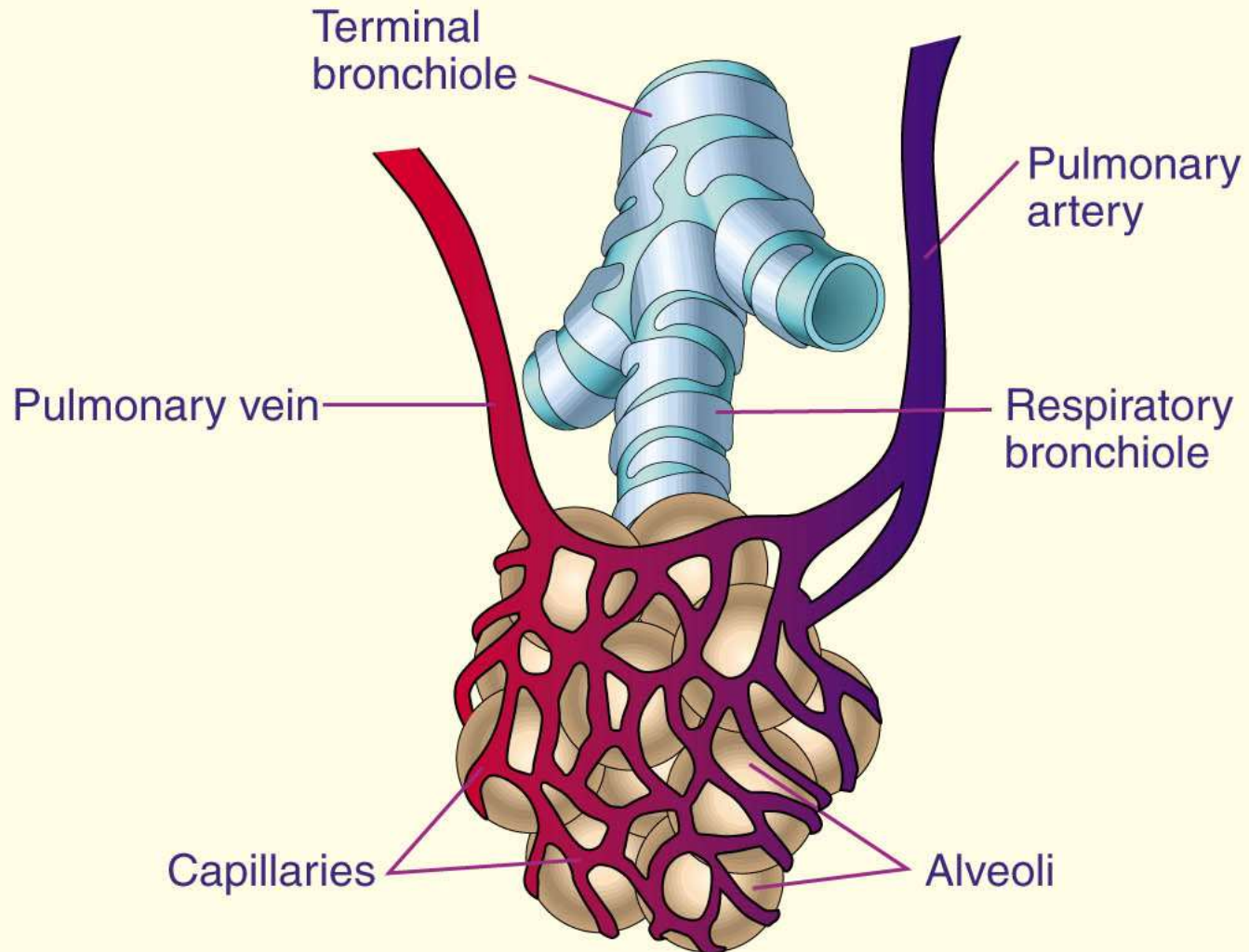
**Anteriorly** the Trachea Bifurcates Below the **Sternal angle**; **Posteriorly**, at the level of **T4 or T5**

The **right bronchus** is shorter, wider, and more vertical than the left (aspiration , Intubation )

**Acinus** The functional unit of the respiratory tract Bronchioles, alveolar ducts, alveolar sacs, & alveoli




# The Acinus



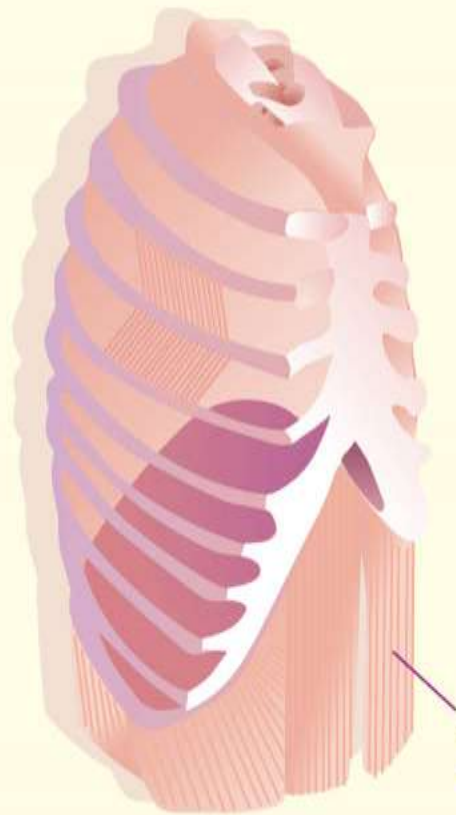
Redrawn from Ignatavicius, et. al., 1999

# Mechanics of Respiration

- ▶ 4 Major Functions of the Respiratory System :
    1. Supply O<sub>2</sub> for energy production .
    2. Remove CO<sub>2</sub> , waste product of energy reactions .
    3. Homeostasis (acid-base balance) of arterial blood .
    4. Heat exchange .
- 

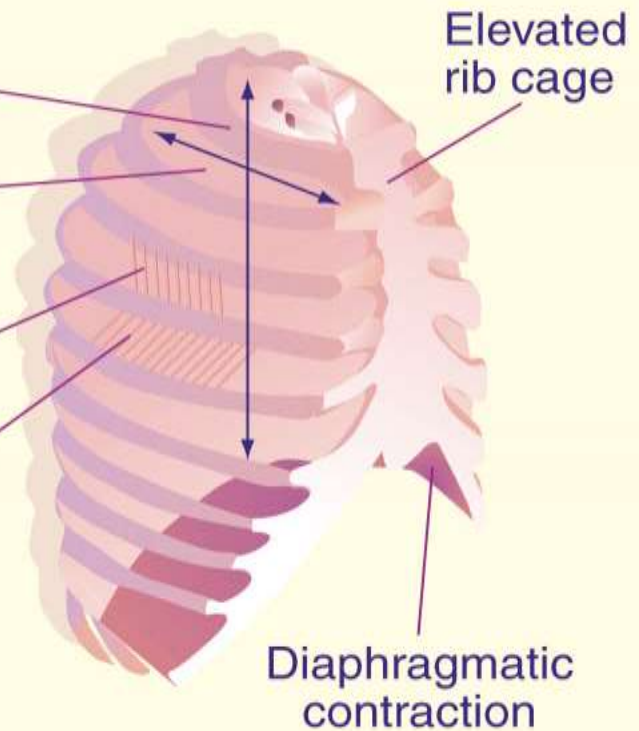
# Expansion of the Thoracic Cage

## EXPIRATION



Abdominals contracted

## INSPIRATION



Increased vertical diameter

Increased A-P diameter

External intercostals contracted

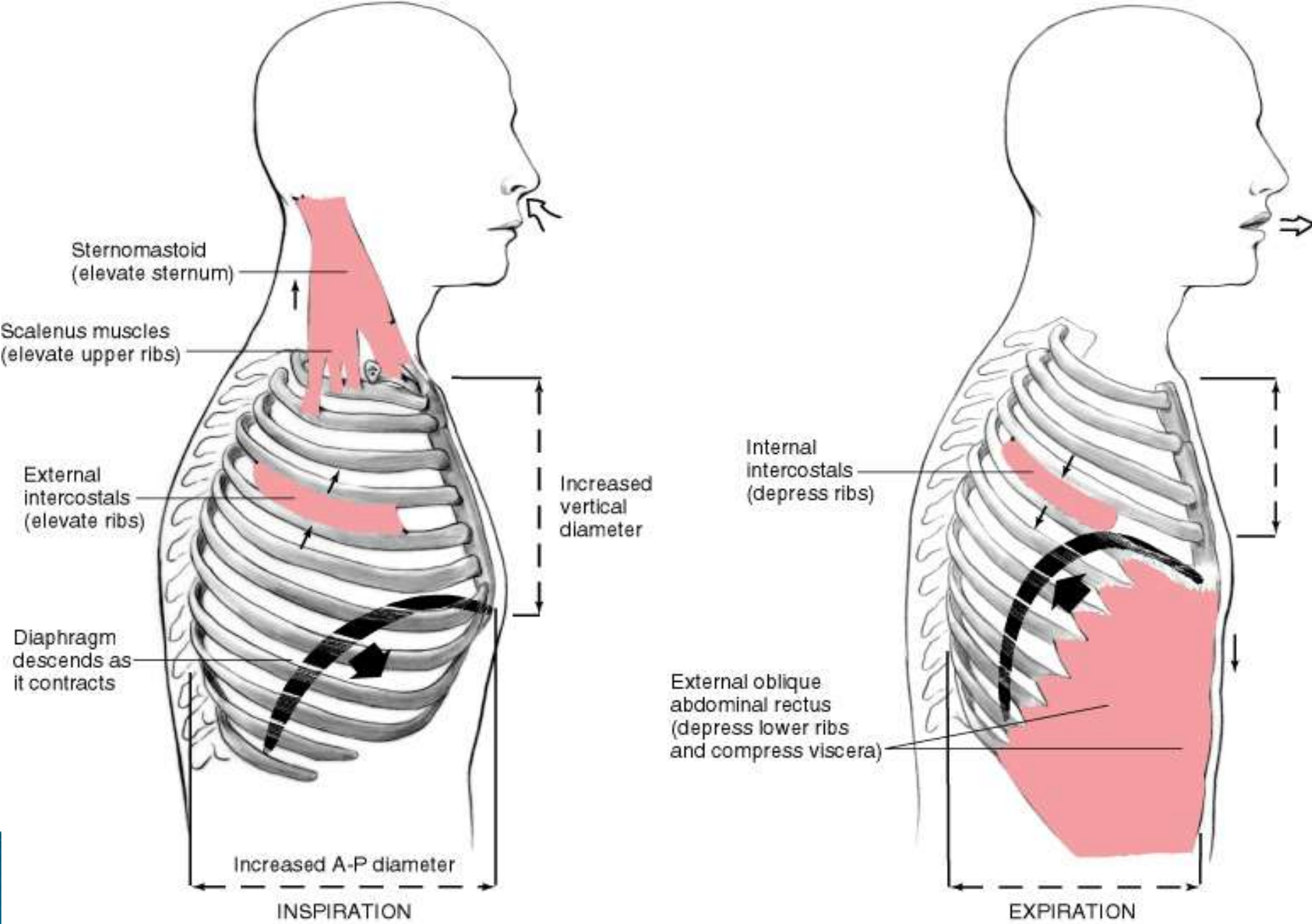
Internal intercostals relaxed

Elevated rib cage

Diaphragmatic contraction

From Guyton, 1996





# Changes with Aging

- ▶ The costal cartilages become **calcified**.
- ▶ The respiratory **muscle strength** declines after age 50.
- ▶ The **elastic** properties within the lungs decrease, making them less distensible and lessening their tendency to collapse and recoil.
- ▶ These changes **lead to**:
  - a decrease in **vital capacity**
  - an increase in **residual volume**.
- ▶ A gradual **loss of intraalveolar septa**
- ▶ A **decreased number of alveoli**

# Subjective Data

- ▶ **Cough**
- ▶ **Shortness of Breath (Dyspnea):** nonpainful but uncomfortable awareness of breathing that is inappropriate to the level of exertion
- ▶ **Chest Pain** with Breathing
- ▶ **Wheezing:** musical respiratory sounds; due to partial airway obstruction from secretions, tissue inflammation or foreign body
- ▶ **Blood-streaked sputum** (hemoptysis)
- ▶ **Past History** of Respiratory Infections
- ▶ **Smoking** History
- ▶ **Environmental Exposure**
- ▶ **Self-care Behaviors**

# Subjective Data

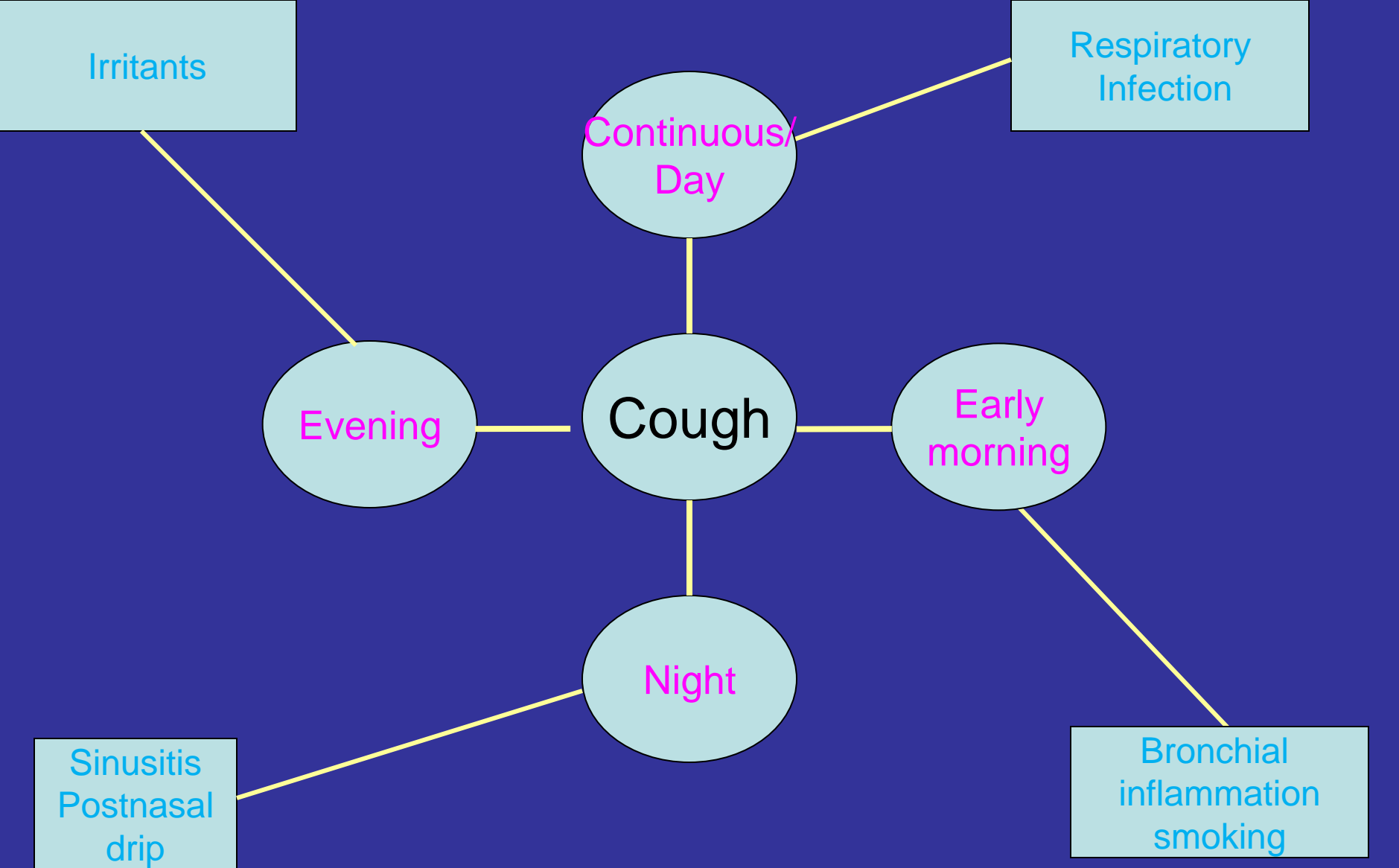
## Cough

- ▶ Duration, Frequency, timing ,  
(**acute**: lasting less than 3 weeks; **subacute**: 3 to 8 weeks; **chronic** more than 8 weeks)
- ▶ Productive or not (hemoptysis)

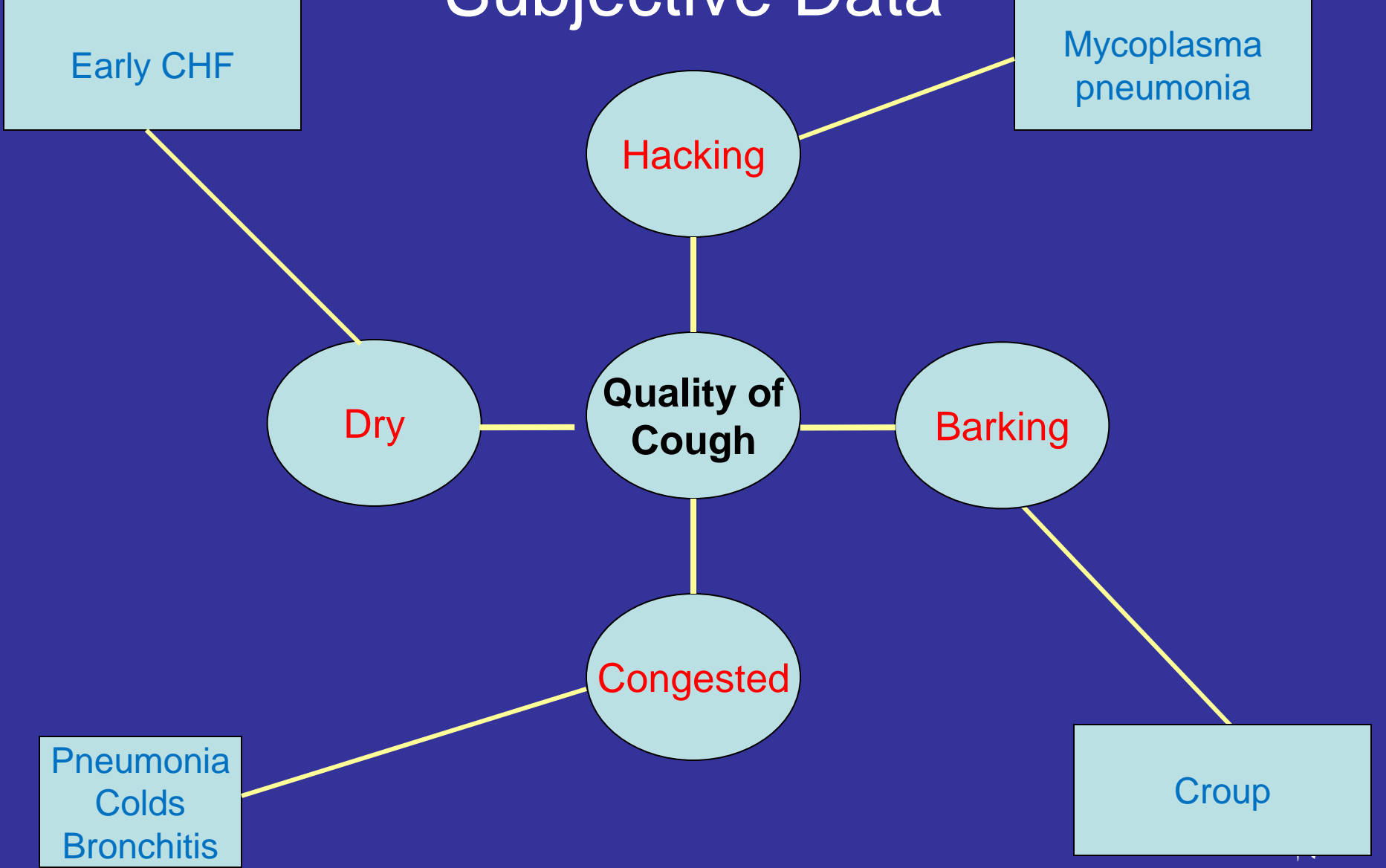
Quality (Hoarse or bubbling, Hacking, Dry, Barking, Congested)

- ▶ Associated factors
- ▶ Any Rx.
- ▶ SOB
- ▶ Allergies
- ▶ ADL

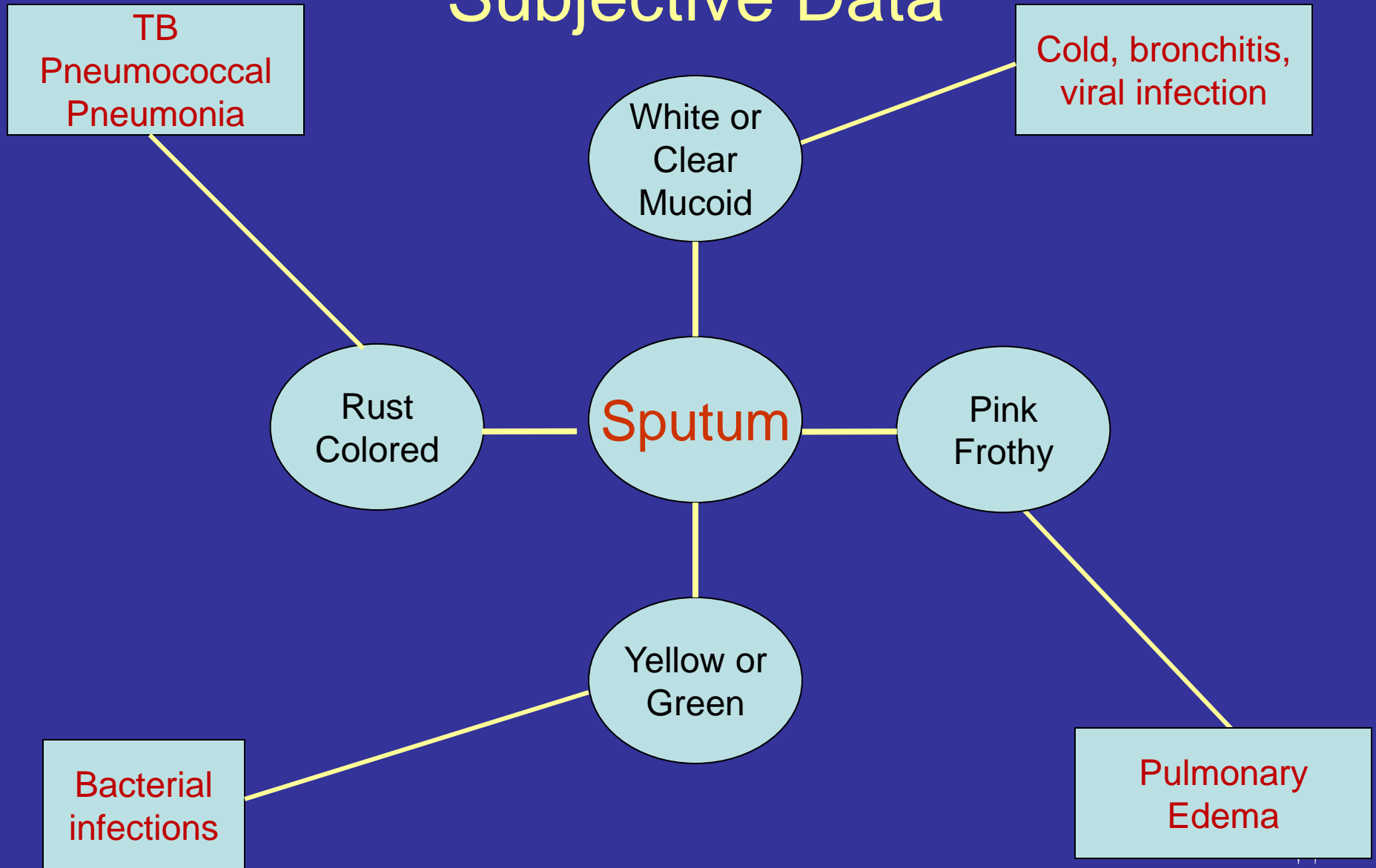
# Subjective Data



# Subjective Data



# Subjective Data



# Subjective Data

- ▶ **Hemoptysis:**

Is the coughing up of blood from the lungs

- ▶ Assess

- volume,
- associated symptoms,
- source of bleeding.



# Subjective Data

- ▶ **SOB: have you had any difficulty breathing?**
  - Precipitating factors
  - Associated factors (diaphoresis, cyanosis)
  - Allergies (Asthma)
  - ADL & effect of SOB on it
  - # of Pillows sleep with
  - Orthopnea
    - Difficulty breathing when supine.
  - PND (paroxysmal nocturnal dyspnea)
    - Awakening from sleep with SOB; need to be upright to achieve comfort.
- ▶ **Chest pain (PQRST)**
- ▶ **Hx. Of resp. Infection (past & Family Hx)**
- ▶ **Smoking Hx.**
- ▶ **Environmental exposure** (factory, farming, coal mine...etc.)
- ▶ **Self-care measures** (TB test, immunization, x-ray, wear mask)

# Objective Data

## Techniques of Examination

- **Initial survey of respiration & the thorax**
  - Observe the **rate, rhythm, depth, and effort** of breathing
  - Inspect for any **signs of respiratory difficulty**
    - Assess the patient's **color**
    - Listen to the patient's **breathing**
    - Inspect the **patient's neck**
  - Observe the **shape** of the chest



# Inspect for the Posterior Chest

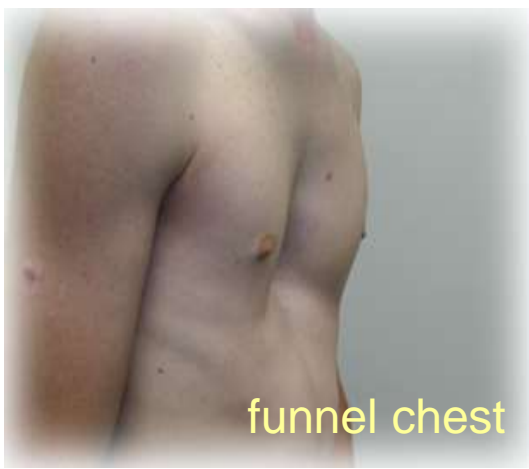
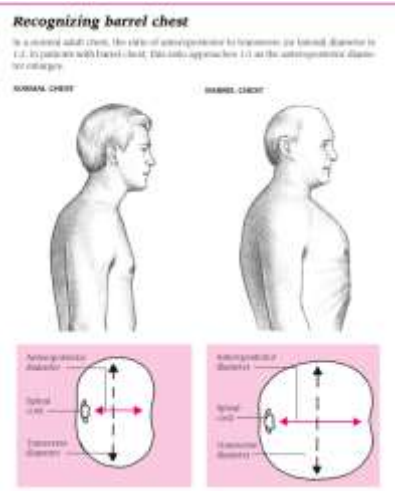


**scoliosis** - Deformities or asymmetry:

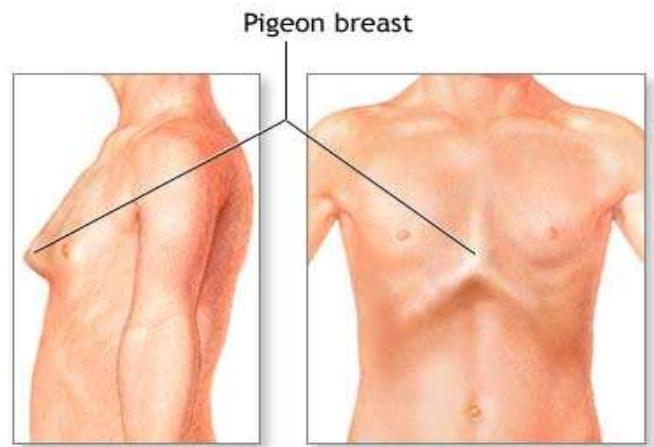
- (scoliosis, kyphosis)
- Anteroposterior : transverse diameter is 1:2
  - (barrel chest due to hyperinflation like in emphysema; funnel chest, pigeon chest)

**kyphosis**

barrel chest COPD



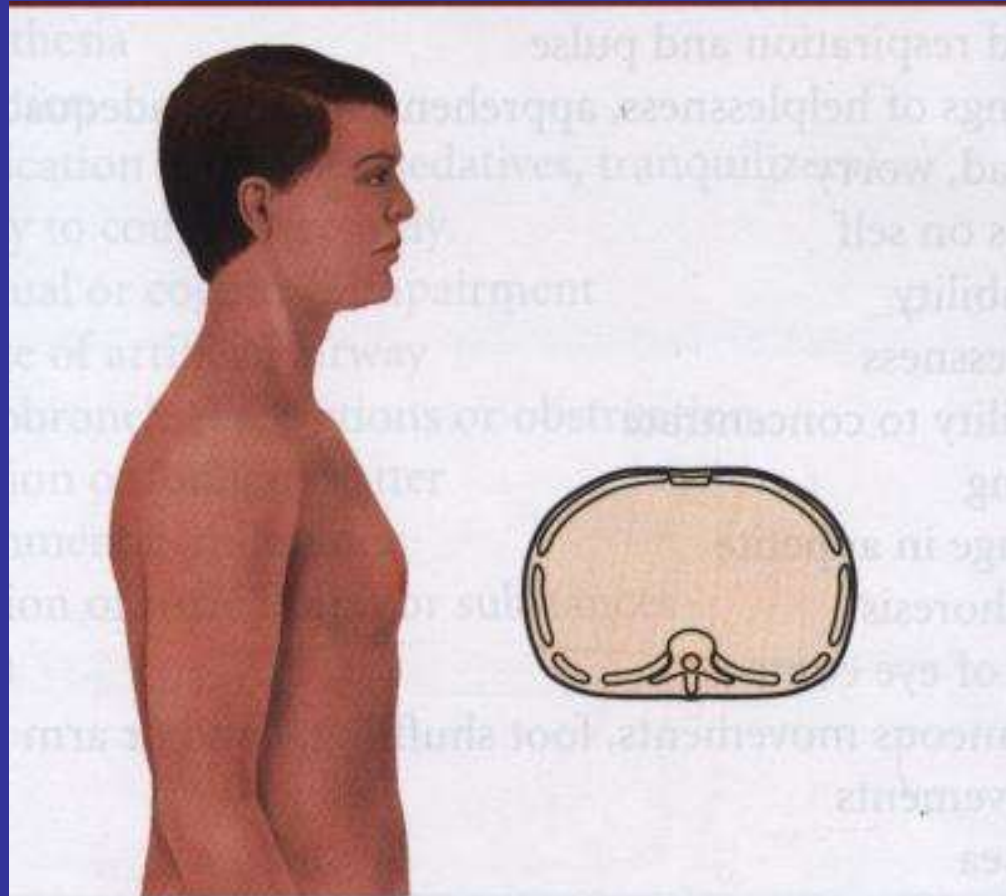
funnel chest



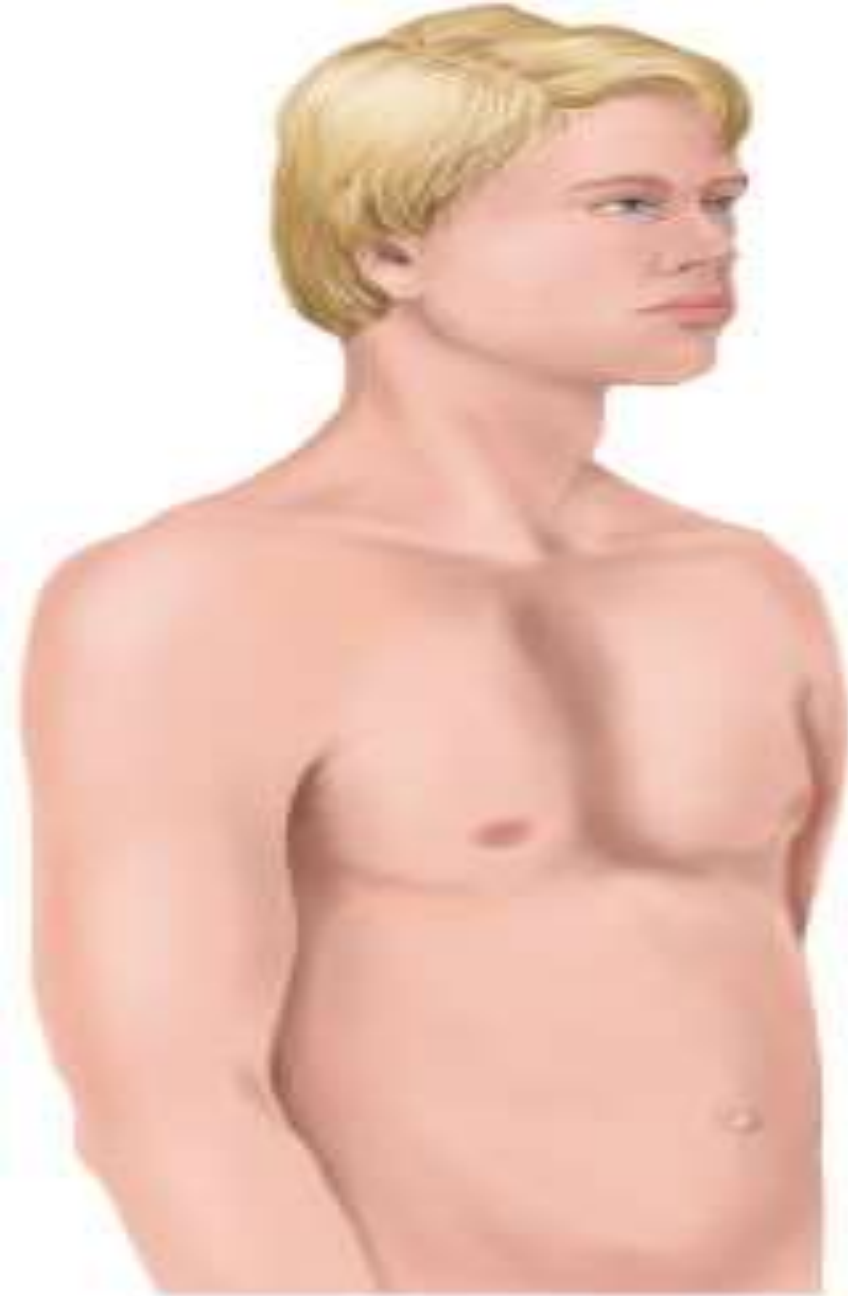
Pigeon breast

# Abnormalities (configuration)

Normal Adult

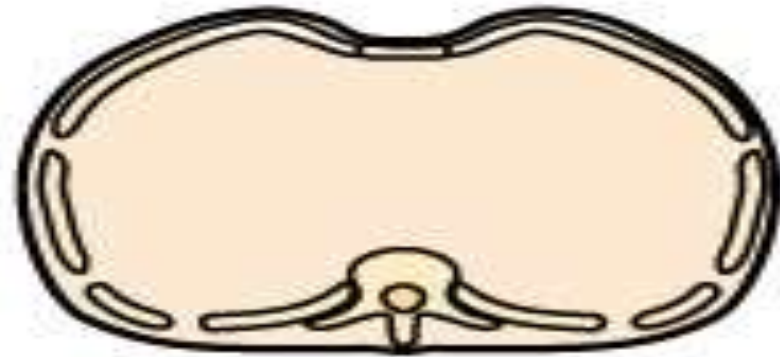


Normal Adult (for Comparison)



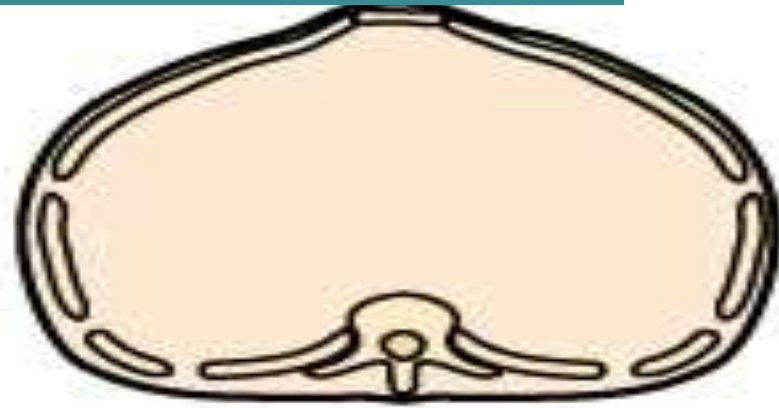
***Pectus Excavatum (Funnel)***

**Sunken sternum  
(Funnel breast)  
congenital**



**Pectus Carinatum**  
**(Pigeon)**

Forward protrusion of the sternum  
(Pigeon breast),  
More common



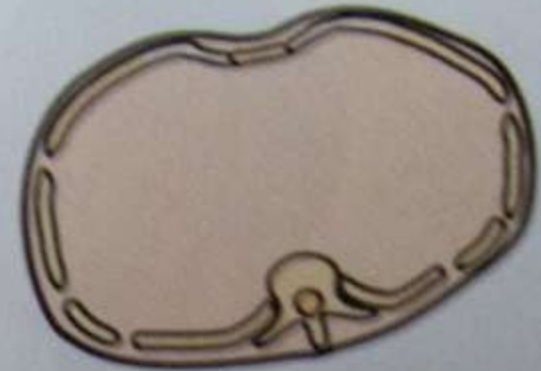
# Abn. Post . Chest.....cont.....



●Pectus carinatum



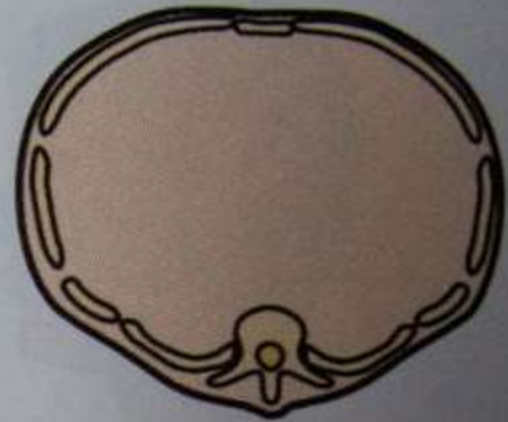
Pectus excavatum



- Lateral S-shaped curvature of thoracic and lumbar spine
- Cardiopulmonary impairment

Scoliosis

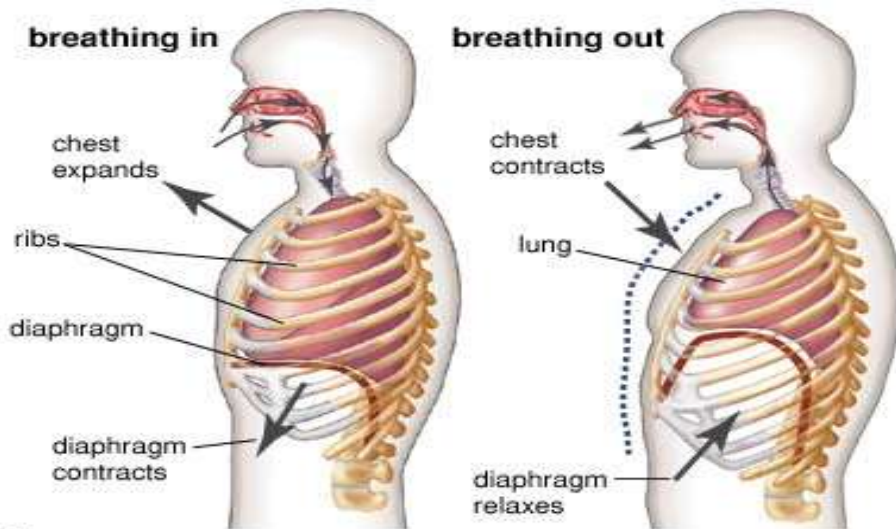




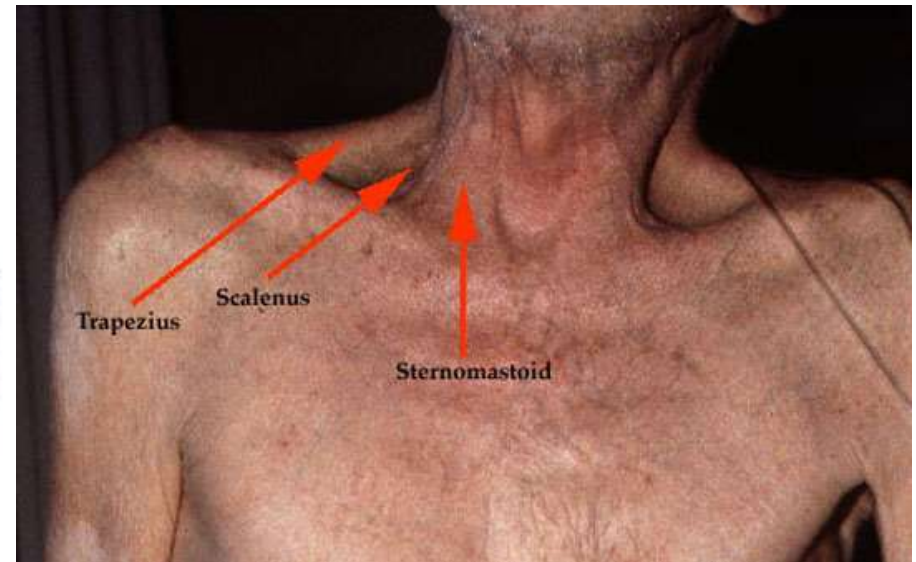
**Kyphosis**

- (Humpback)
- Exaggerated **curvature of the thoracic spine**
- Pain and limited mobility

- **Color:** Skin, nail, & lips color (**no cyanosis no pallor**)
- **Use of accessory muscles** (trapezius, neck muscles, rectus abdomenus, intercostal)
  - Note any hypertrophy of neck or accessory muscles (as may be seen in COPD)



© 2006 Encyclopædia Britannica, Inc.



# Objective Data

Cont.

- **Inspect the Posterior Chest for:**
  - Evaluate the **respiration** for:  
*rate, rhythm or pattern*
  - Inspect **chest movement** with breathing for: symmetry, bulging/ retraction, use of accessory muscles.
  - Note any **audible sounds** with respiration
    - **Noisy:** Asthma or chronic bronchitis
    - **Wheezes, stridor**

# Palpation of posterior chest

**Palpate the chest for the following:**

- Identify **tender areas**: pain, lesions/ bruises
- Assess any **abnormalities** such as masses & lumps

**Test chest expansion:**

- Place your **thumbs at the level of 10<sup>th</sup> ribs**, with your fingers grasping laterally the rib cage.
- Ask pt to **inhale deeply**. Watch the **distance** between your thumbs as they move apart during inspiration.
- Feel for the **range and symmetry** of the rib cage it expands

# Palpate Posterior Chest Symmetrical Chest Expansion



Marked  
Atelectasis or  
Pneumonia,  
Chest trauma,  
# ribs  
Pneumothorax

At the level of 10<sup>th</sup> rib

# Feel for Tactile fremitus

Fremitus refers to the palpable **vibrations** transmitted through the **bronchopulmonary tree** to the **chest wall** as the patient is speaking.

## Intensity factors:

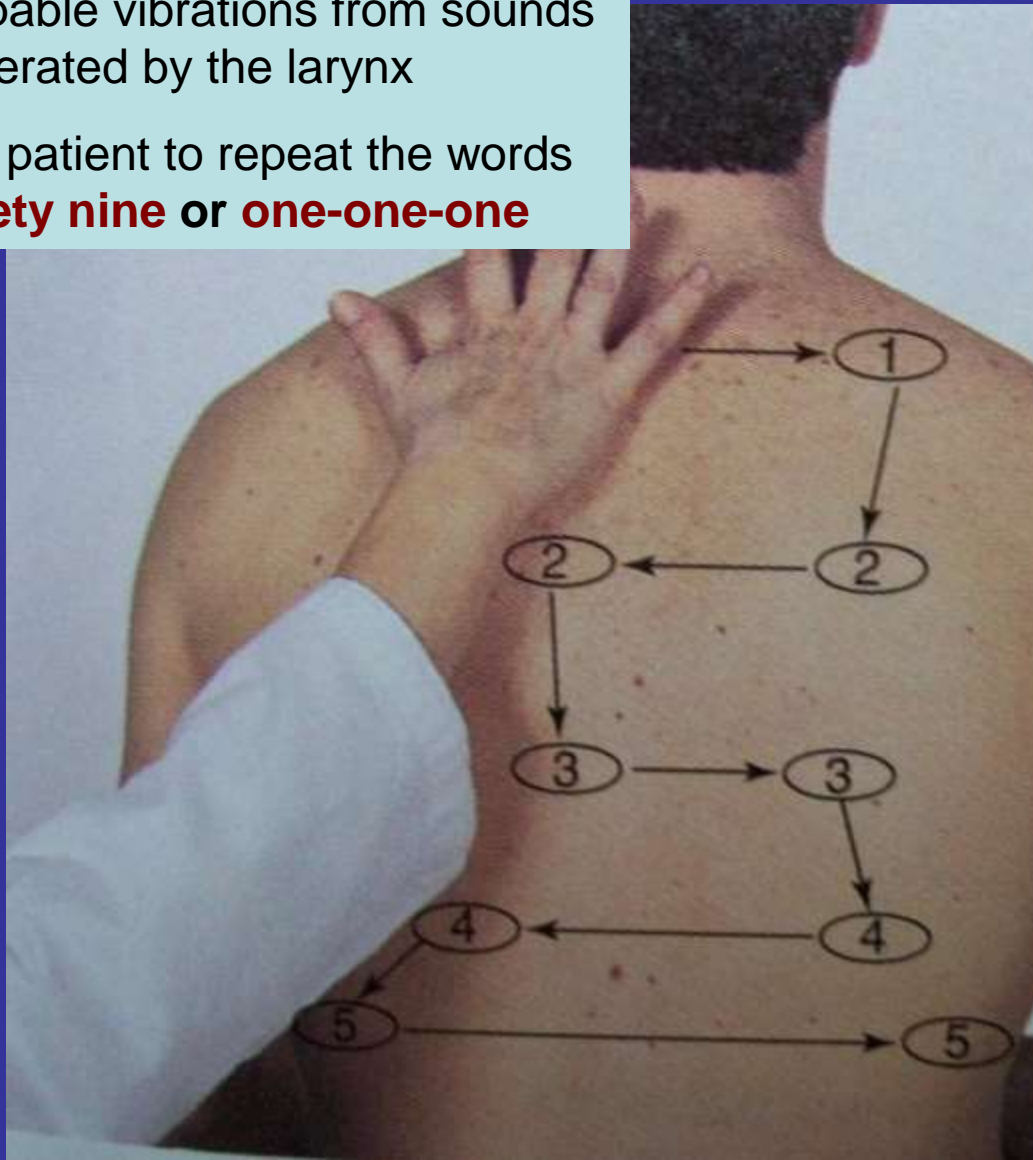
- Relative **location of bronchi** to the chest wall
- **Thickness of the chest wall**
- **Pitch and intensity**

Fremitus is typically **more prominent** in the **interscapular area** than in the lower lung & in the **right side** more prominent than in the left.

# Palpate Posterior Chest Symmetrical & Tactile Fremitus

Palpable vibrations from sounds generated by the larynx

Ask patient to repeat the words **ninety nine** or **one-one-one**



**Decreased:** when the voice is **soft**

**as a result :** obstruction, pneumothorax, emphysema, pleural effusion or thickening.

**Increased:** with **consolidation** as in pneumonia.

**Rhonchal fremitus:** palpable with thick **bronchial secretions**.

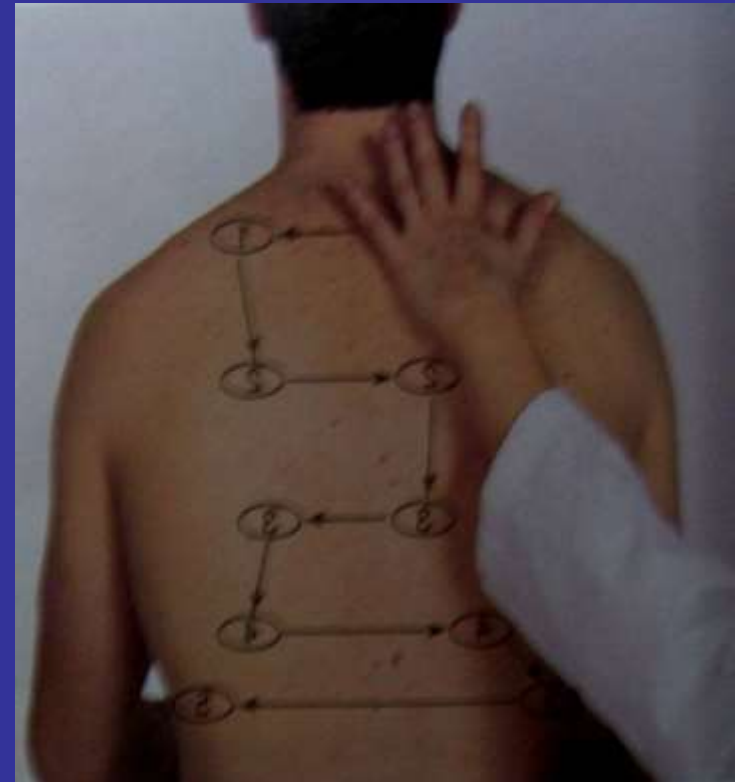
**Pleural Friction fremitus:** with **inflammation**.

**Crepitus:** **coarse crackling sensation** palpable over skin as in subcutaneous **emphysema** after thoracic injury

# Palpation

Continued

- Temperature
- Tenderness
- Moisture
- Lumps
- Masses
- Costal margin



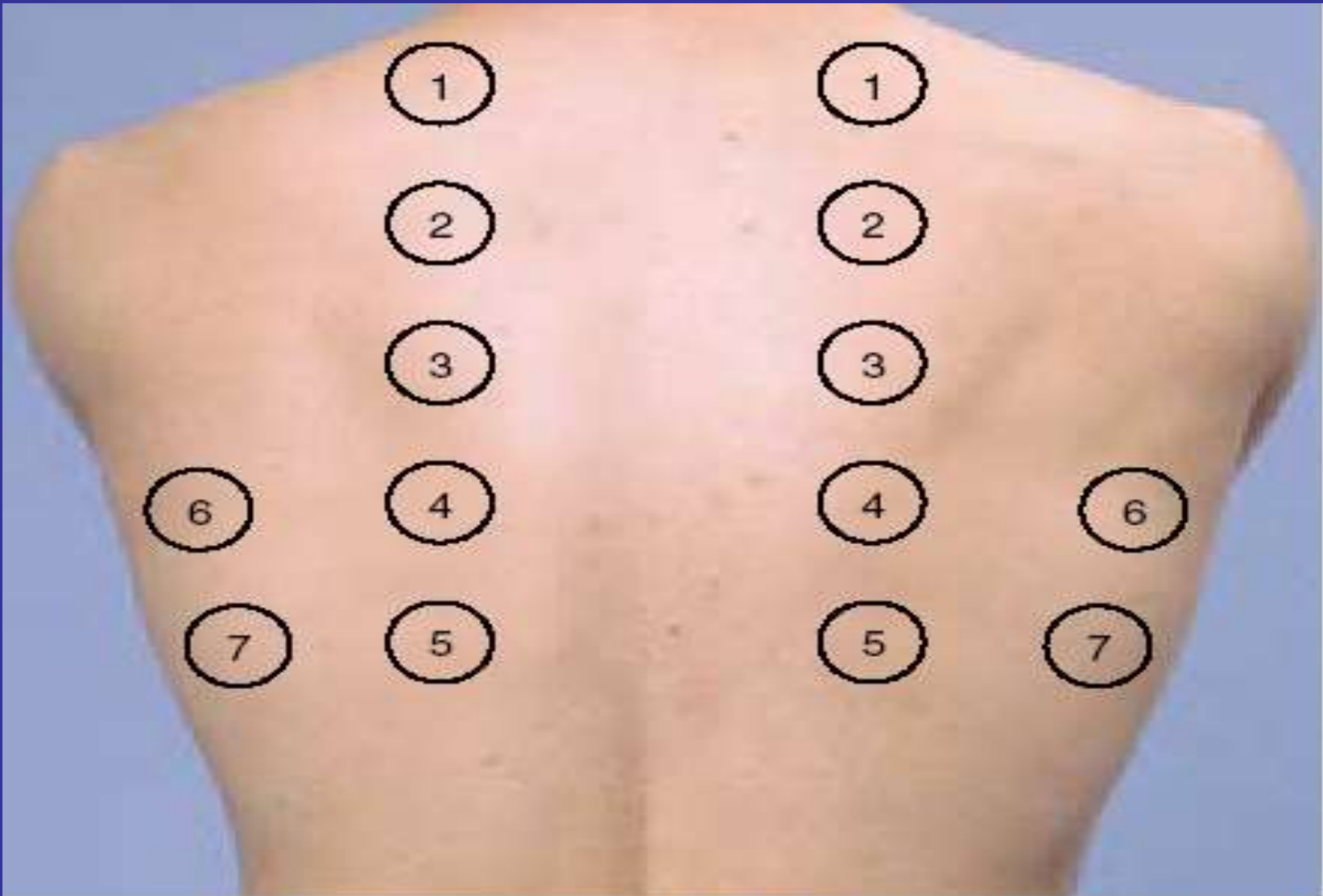


# Percussion

- Sets chest wall and underlying tissue in motion, producing **audible sounds and palpable vibrations.**
- Helps in **underlying the tissues if air filled, fluid filled or solid.**

## \*\* Compare all areas bilaterally

- While the pt **arms crossed** in front of the chest.
- Percuss the thorax from the **apices to the base** of the lung
- **resonance** (lung), **Flatness** (bone), **dullness** (liver), **tympany** (gastric airbubble), **hyperresonance** (none)
- Resonance is related with **dullness when fluid or solid tissue replace air** - containing lungs



**LOCATIONS FOR PERCUSSION AND AUSCULTATION**

**Hyperextend the middle finger (Lt hand pleximeter finger).**

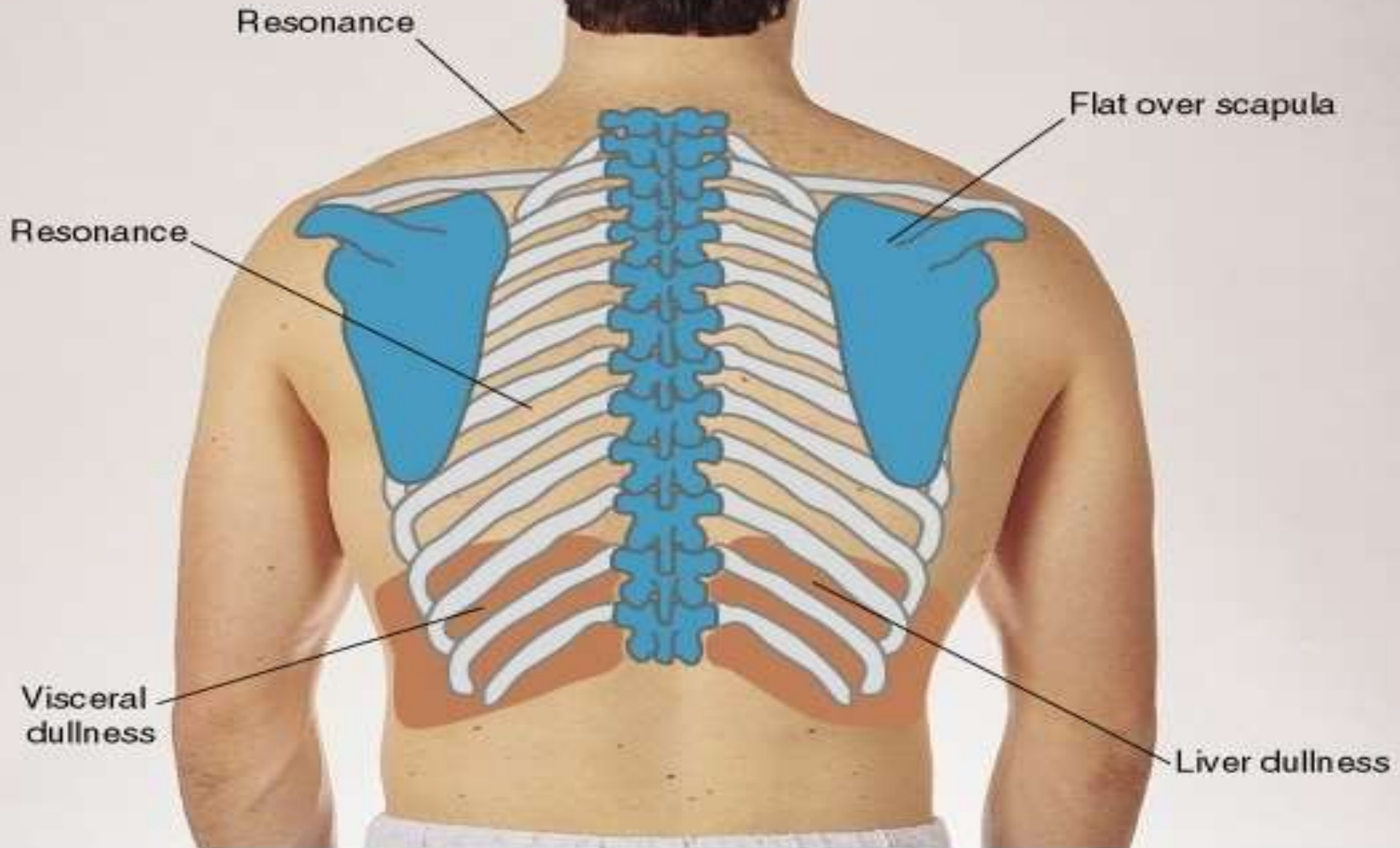
**press interphalangeal joint** firmly on the surface to be pressed.



With a quick, **sharp strike the pleximeter finger** with the **right** middle finger or plexor finger. **(to transmit vibrations through the bones)**



*Expected  
Percussion notes*



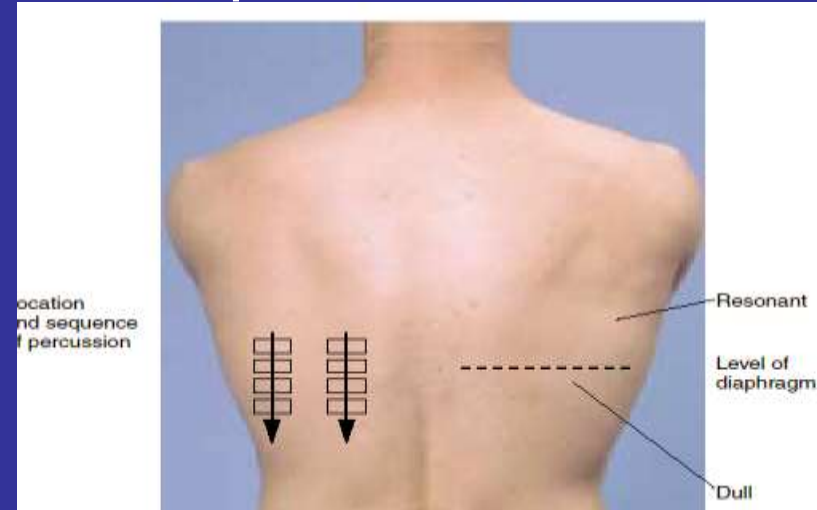
## Percussion Notes and Their Characteristics

	Relative Intensity	Relative Pitch	Relative Duration	Example of Location
Flatness	Soft	High	Short	Thigh
Dullness	Medium	Medium	Medium	Liver
Resonance	Loud	Low	Long	Normal lung
Hyperresonance	Very loud	Lower	Longer	None normally
Tympany	Loud	High*	*	Gastric air bubble or puffed-out cheek

\* Distinguished mainly by its musical timbre.

# Diaphragmatic excursion:

- determine the level of diaphragmatic dullness during quiet respiration
- Holding the pleximeter finger above the parallel to the expected level of dullness
- percuss downward in progressive steps until dullness clearly replaces resonance (**Ins**)



determining the **distance between the level of dullness on full expiration & dullness on full inspiration. Normally: 5-6 cm**

# Percussion of Posterior Chest Diaphragmatic Excursion

A

*Exhale*



*Inhale*



Abnormal high level of dullness and absence or excursion in:

- pleural effusion
- atelectasis of lower lobes

# Auscultate Posterior Chest

- Breath Sounds
- Adventitious or added Sounds
- Transmitted Voice Sounds (when patient's spoke or whispered).
- **Normal sounds:** vesicular, bronchovesicular and bronchial.
- **Note: pitch, intensity, durations of the expiratory - inspiratory phase.**

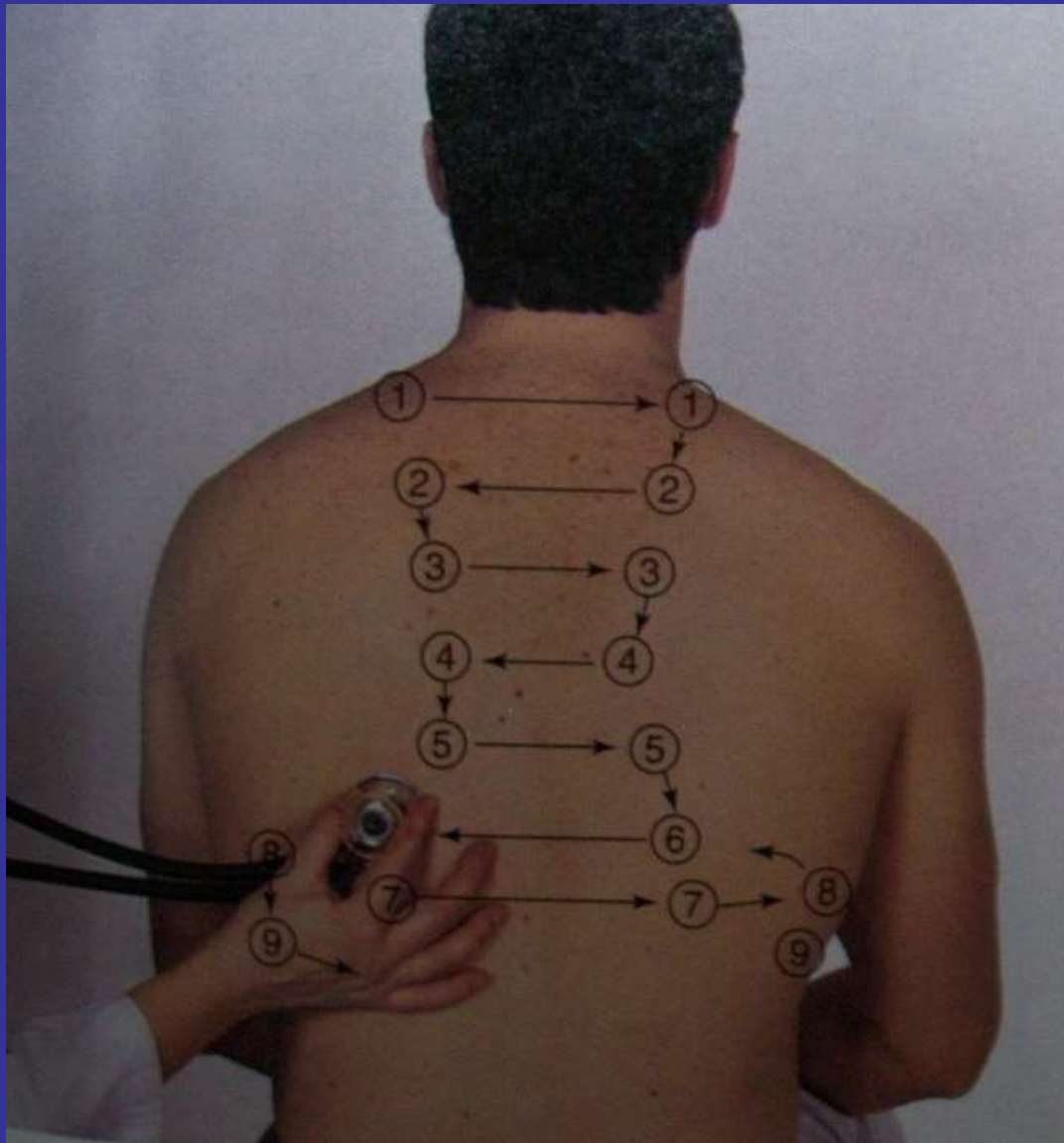


# Auscultation Technique

- Patient **sitting, breathing slowly and deeply through mouth**
- **Avoid hyperventilation!**
- Use **diaphragm** steth. & placed **firmly** on the skin
- Listen to **anterior, posterior & lateral**
- Must listen to **at least 1 full respiration** before moving stethoscope side to side
- **Compare both sides** (lung fields)

# Auscultation of Posterior Chest

## Breath Sounds - sequence



**Listen to full breath**

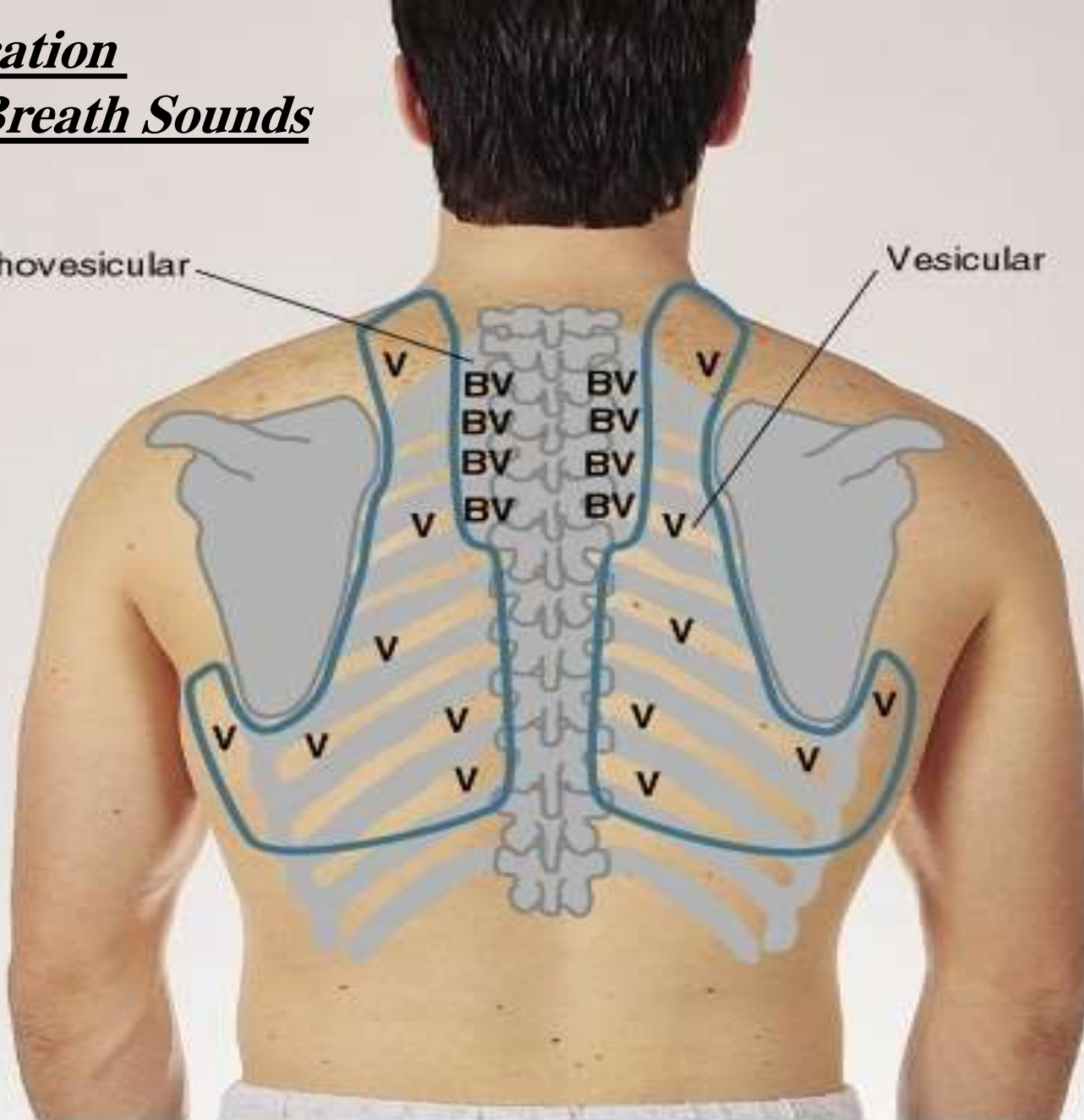
**Decreased or Absent:** if bronchial tree is **obstructed**, **lungs hyperinflated** (**emphysema**), or **transmission is poor** such as in **pneumothorax (air)**, **COPD**, or **pleural effusion** on **pleural thickening**

**Increased:** when **consolidation** (**pneumonia** & **pulmonary edema**) or **compression** (**fluid in pleural space**) cause dense areas that **enhance transmission**.

# Location of Breath Sounds

Bronchovesicular




Vesicular



# Auscultation of Posterior and Anterior Chest

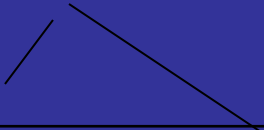

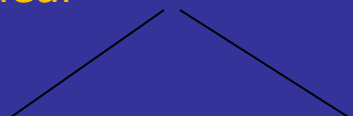

## Characteristics of Normal Breath Sounds

### *Characteristics of Breath Sounds*

	<b>Duration of Sounds</b>	<b>Intensity of Expiratory Sound</b>	<b>Pitch of Expiratory Sound</b>	<b>Locations Where Heard Normally</b>
<b>Vesicular*</b> 	Inspiratory sounds last longer than expiratory ones.	Soft	Relatively low	Over most of both lungs
<b>Broncho-vesicular</b> 	Inspiratory and expiratory sounds are about equal.	Intermediate	Intermediate	Often in the 1st and 2nd interspaces anteriorly and between the scapulae
<b>Bronchial</b> 	Expiratory sounds last longer than inspiratory ones.	Loud	Relatively high	Over the manubrium, if heard at all
<b>Tracheal</b> 	Inspiratory and expiratory sounds are about equal.	Very loud	Relatively high	Over the trachea in the neck

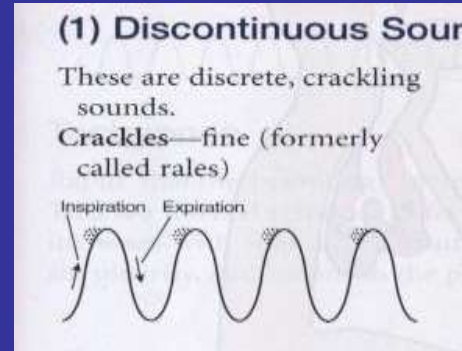
\* The thickness of the bars indicates intensity; the steeper their incline, the higher the pitch.

# Characteristics of Normal Breath Sounds

	Pitch	intensity	Duration	Quality	Normal Location
<b>Bronchial</b> 	high	loud	insp < exp	harsh, hollow tubular	Over the manubrium
<b>Bronchovesicular</b> 	intermediate	intermediate	Insp = exp	Mixed	Anteriorly in the 1 <sup>st</sup> & 2 <sup>nd</sup> interspaces and Between scapula.
<b>Tracheal</b> 	high	Very loud	Insp = exp	harsh	Over the trachea in the neck
<b>Vesicular</b> 	Low	Soft	Insp > exp	Wind in trees, rustling	Over most of both lungs

# Auscultation of Posterior and Anterior Chest

## Adventitious Breath Sounds



- **Crackles (rales): Discontinuous**

Intermittent, nonmusical, & brief (**pneumonia, CHF, bronchitis**) like dots in time

- **Fine crackles:** soft, high-pitched, very brief (5-10 msec)  
.....
- **Coarse crackles:** louder, lower pitch, brief (20-30 msec)

- **Wheeze (Rhonchi): Continuous**

Musical, prolonged, like dashes in time. More than 250 msec  
(**Narrowed airways in asthma, COPD**)

- **Wheezes:** High pitch musical *squeaking*, more than 400 Hz
- **Rhonchi:** low-pitched musical, with *snoring, moaning* quality less than 200 Hz

For adventitious sounds note their **timing & location**

# Listening to adventitious sounds

## *Adventitious Lung Sounds*

DISCONTINUOUS SOUNDS (CRACKLES OR RALES) are intermittent, nonmusical, and brief—like dots in time

*Fine crackles* (• • • • •) are soft, high pitched, and very brief (5–10 msec).

*Coarse crackles* (■ ■ ■ ■ ■) are somewhat louder, lower in pitch, and not quite so brief (20–30 msec).

CONTINUOUS SOUNDS are > 250 msec, notably longer than crackles—like dashes in time—but do not necessarily persist throughout the respiratory cycle. Unlike crackles, they are musical.

*Wheezes* (██████) are relatively high pitched (around 400 Hz or higher) and have a hissing or shrill quality.

*Rhonchi* (vvvvvv) are relatively low pitched (around 200 Hz or lower) and have a snoring quality.

# Auscultation of Posterior and Anterior Chest **transmitted Voice Sounds** (if lung pathology is suspected)

- **Bronchophony**
  - “99, 99, 99”
  - Normal: hear soft, muffled, indistinct voice.
  - **Abnormal: hear clear “99”**
- **Egophony (voice of goat)**
  - “eeeeeeeeeee”
  - Normal: should hear a muffled long E sounds
  - **Abnormal: hear “E to A” change.**
- **Whispered Pectoriloquy**
  - 99 or “1-2-3”
  - Normal: faint, muffled, almost inaudible voice.
  - **Abnormal: heard louder and clear.**



# Inspect the Anterior Chest

- **Deformities or symmetry**
- **Shape and configuration**
- **Color and condition**
- **The quality of respirations**  
(note any **retraction** of the interspaces, using accessory muscles, supraclavicular retraction and **respiratory rate**.)
- **Respiratory movement**

# Palpate the Anterior Chest

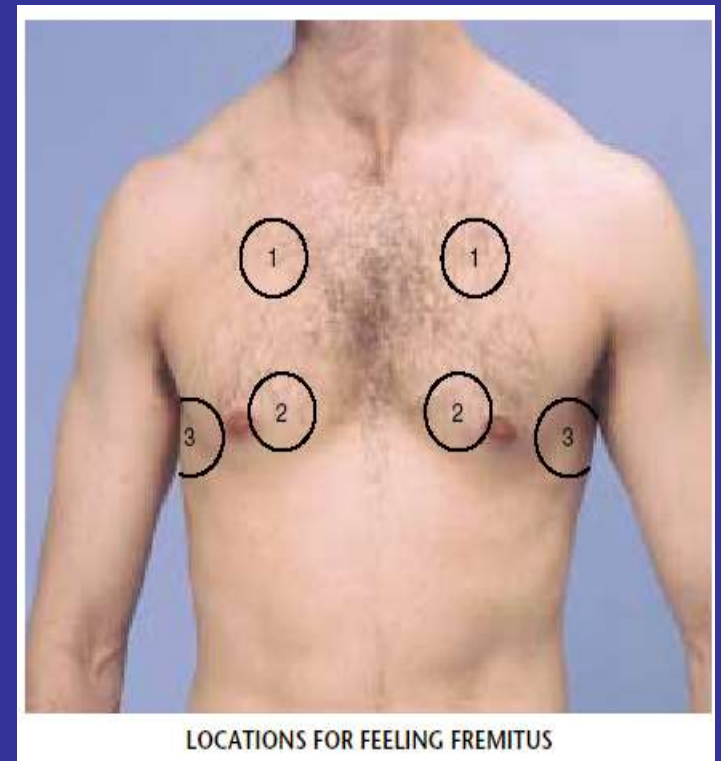
- Palpate the anterior chest wall
- Identification of **tender** areas
- Assessment of **observed abnormalities**
- Symmetric **Chest expansion**
- **Tactile Fremitus**

# Chest Expansion



# Palpate the Anterior Chest

- Assess for Tactile Fremitus :  
**decrease or absent** over the  
pericardium



# Abnormal Tactile Fremitus

- **Decreased tactile fremitus**

Any barrier that gets in the way of the sound.

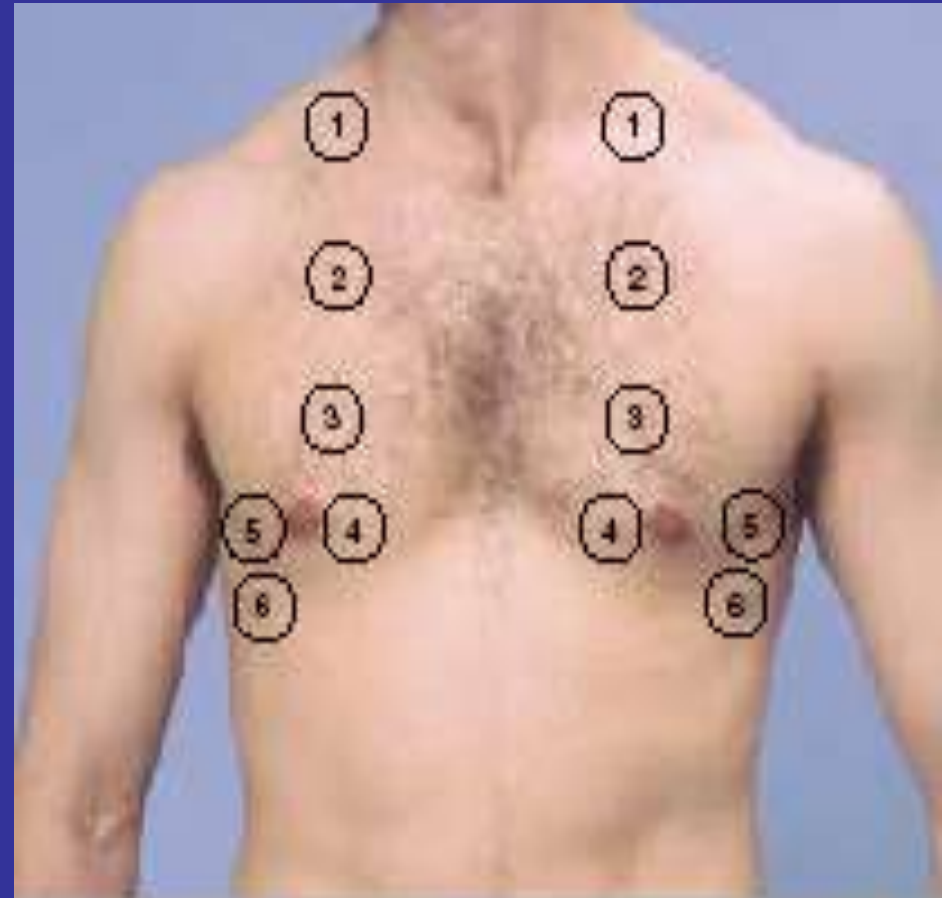
**Obstructed bronchus, pleural effusion or thickening, pneumothorax, and emphysema.**

- **Increased tactile fremitus**

Increased density of lung tissue, **consolidation (pneumonia)**. There must be a patent bronchus and consolidation must extend to lung surface

# Percussion of the Anterior Chest

**Heart –dullness** to  
The **left of the**  
**Sternum** from the **3<sup>rd</sup>**  
**To the 5<sup>th</sup>** interspaces



LOCATIONS FOR PERCUSSION AND AUSCULTATION

# Expected Percussion

## Notes

Resonance

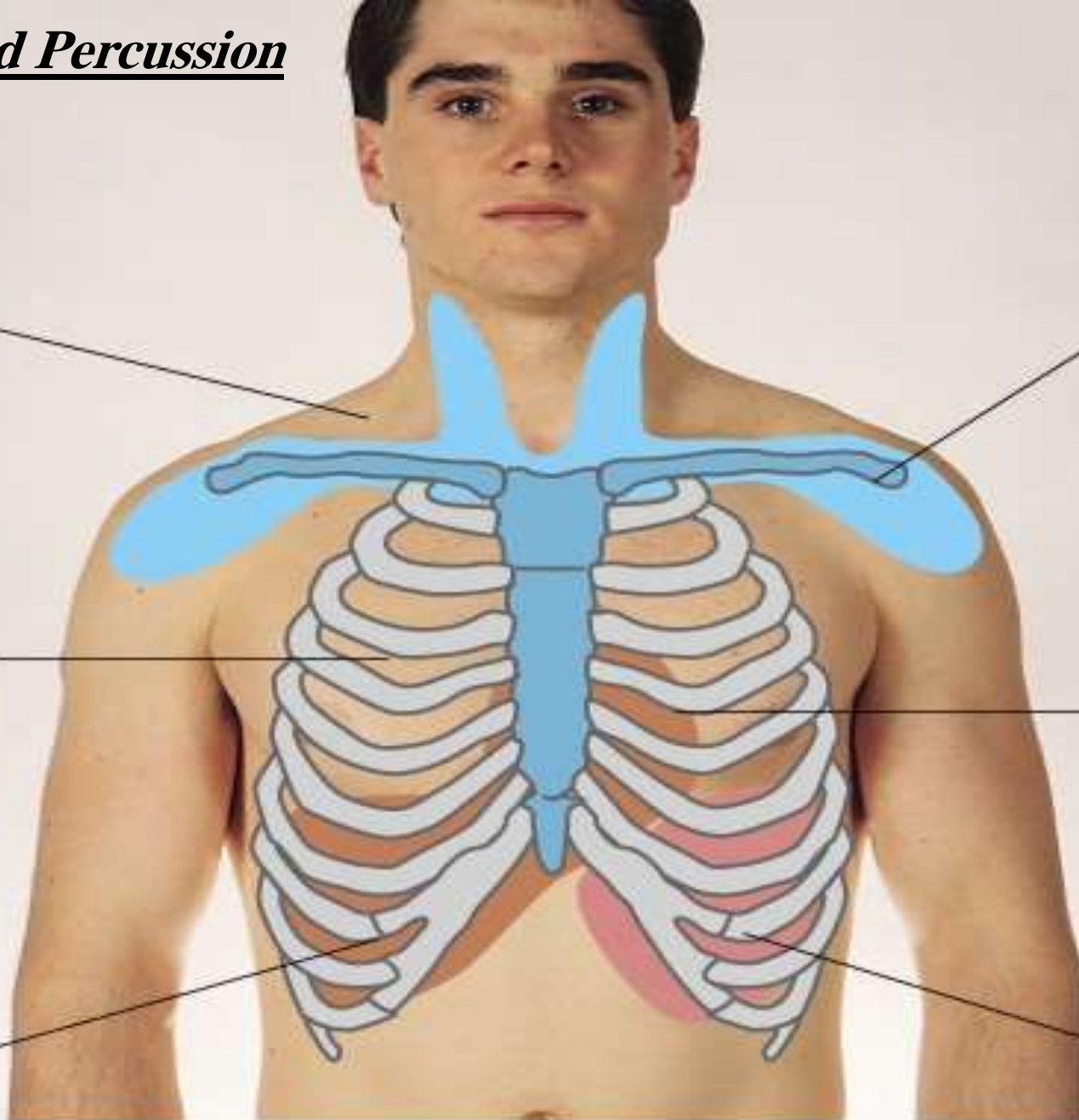
Flat over  
muscle  
and bone

Resonance

Cardiac  
dullness

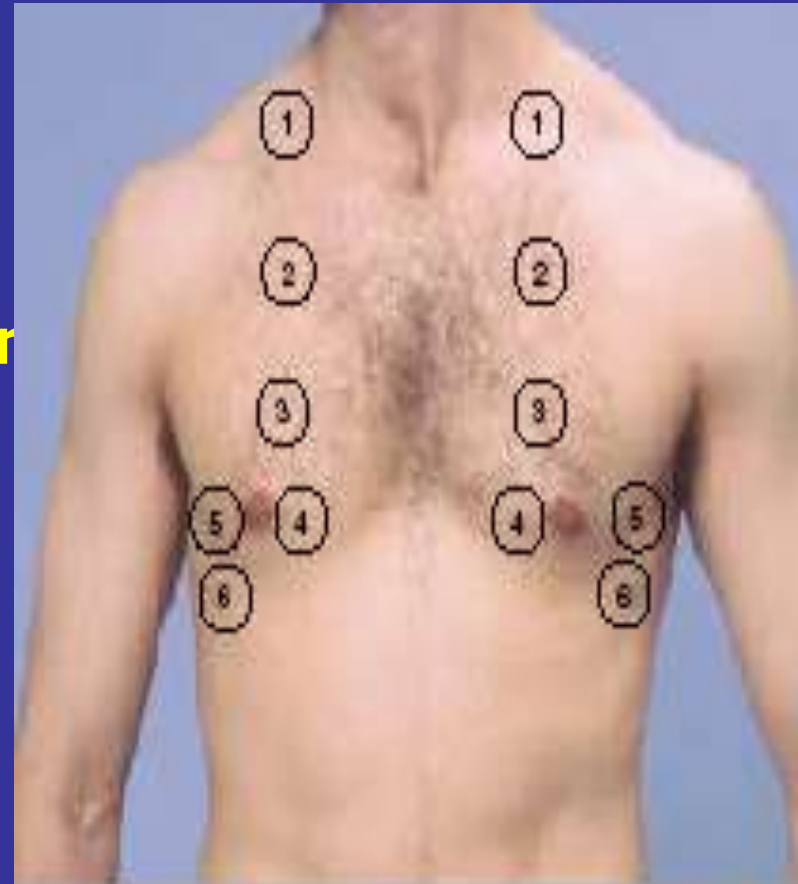
Liver  
dullness

Stomach  
tympany



# Auscultate the Anterior Chest

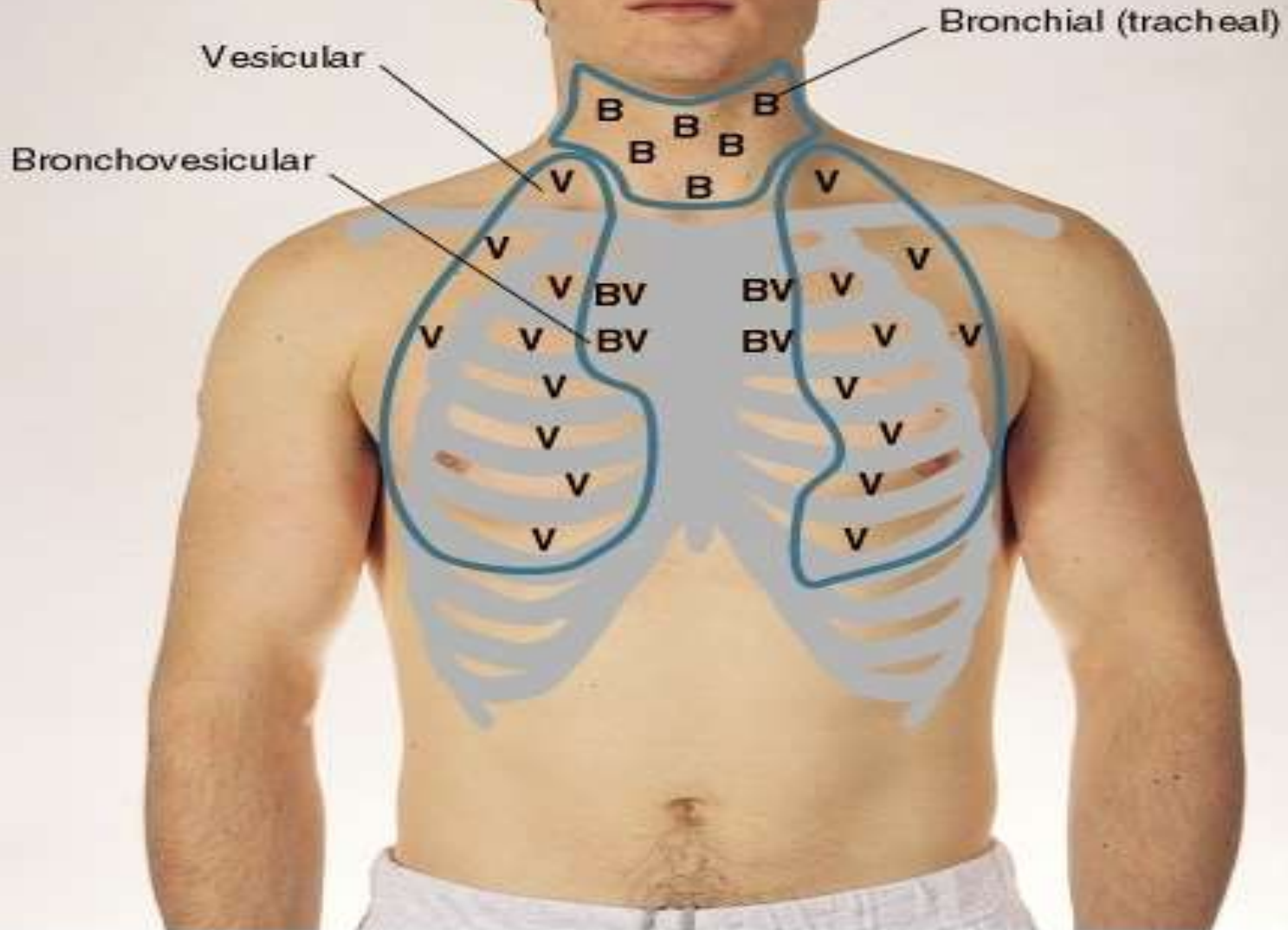
- Over the lung fields from the **Apices (supraclavicular) to 6<sup>th</sup> rib**
- Move **from side to side downward**
- Listen to **one full respiration** in each location
- Evaluate normal breath sounds noting any adventitious sounds.
- Assess voice sounds if necessary.



LOCATIONS FOR PERCUSSION AND AUSCULTATION



# Location Of Breath Sounds

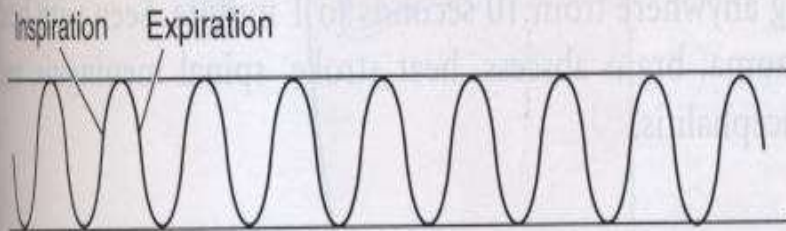


# Respiration Patterns

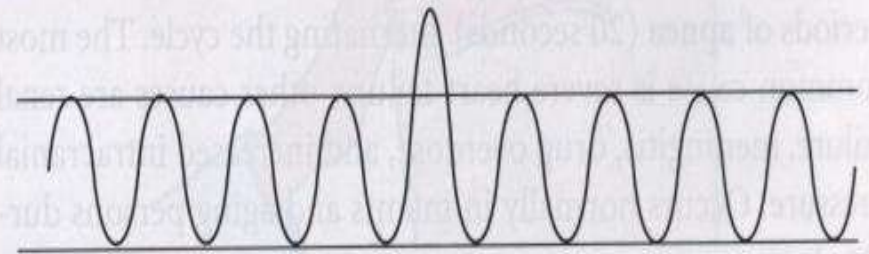
## Normal adult

- Rate 10 -20
- Depth 500 to 800 ml
- Pattern: even
- Pulse to respiration 4:1

TABLE 16-3. Respiration Patterns



Normal Adult (for Comparison)



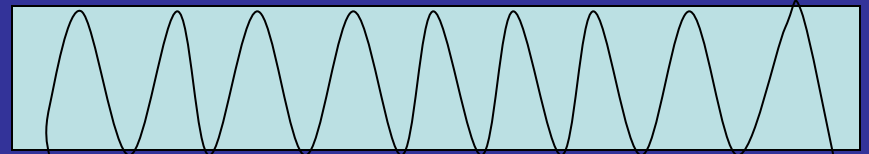
Sigh

- **Tachypnea :**

- **Rapid, Shallow Breathing**

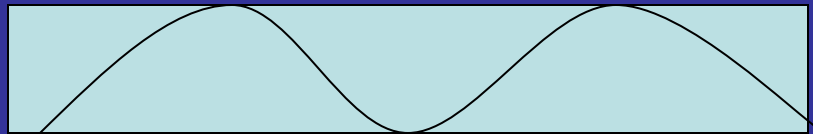
- ↑ rate more than 24/min

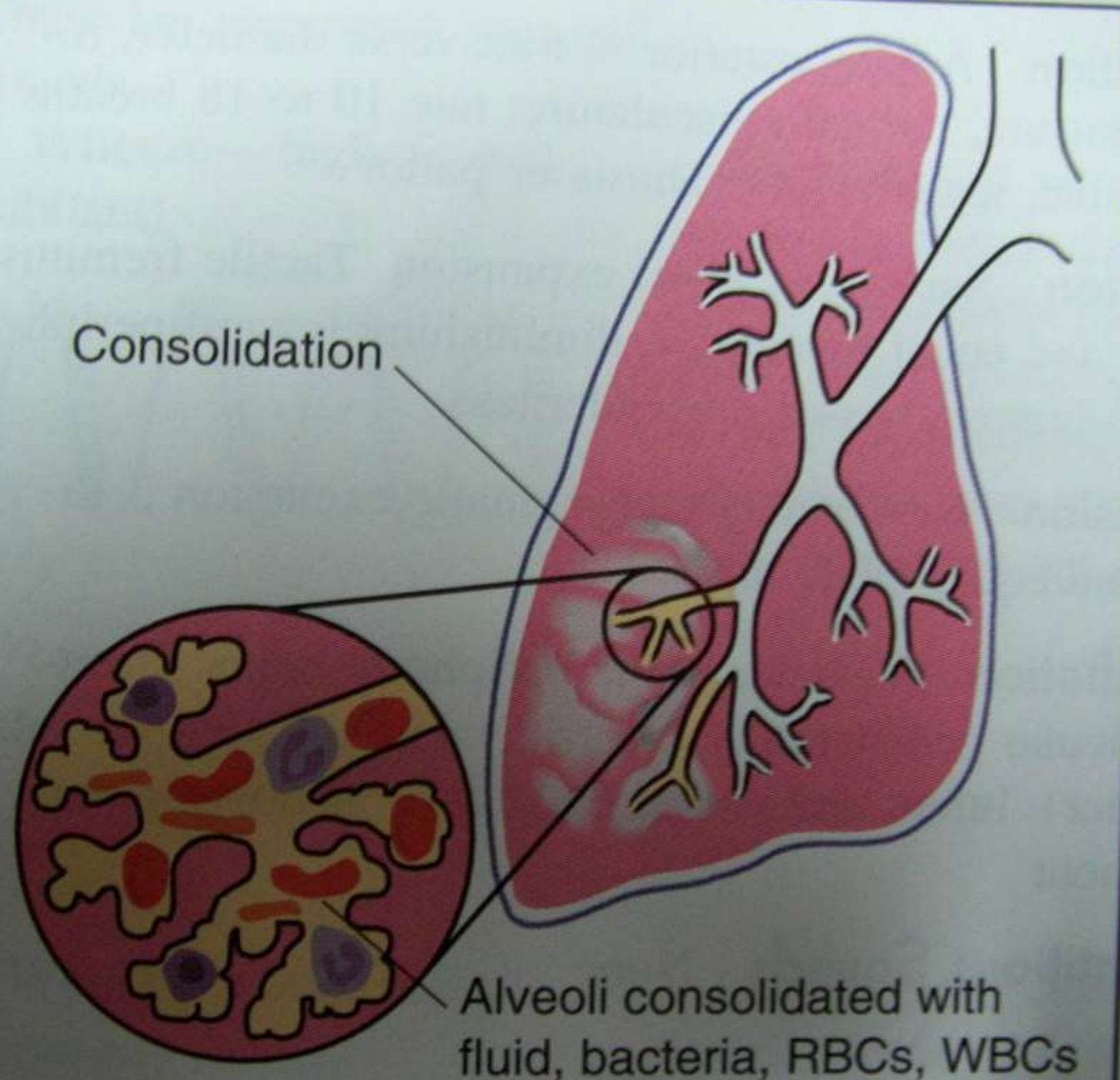
- Normal response to fever, fear, Anxiety, And in case of Pneumonia, and Resp. Insufficiency.



- **Bradypnea**

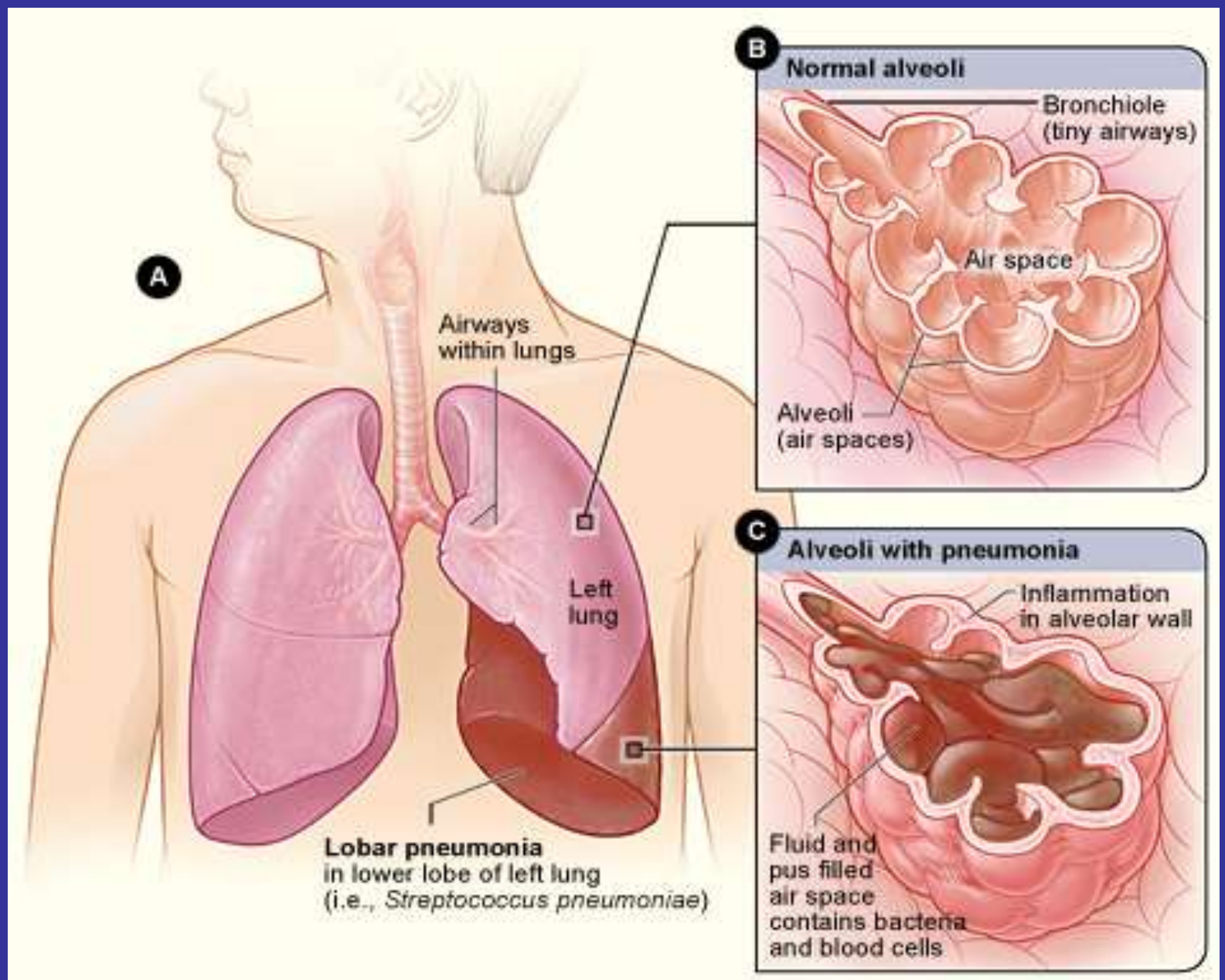
- ↓ rate to 10/min , but Regular



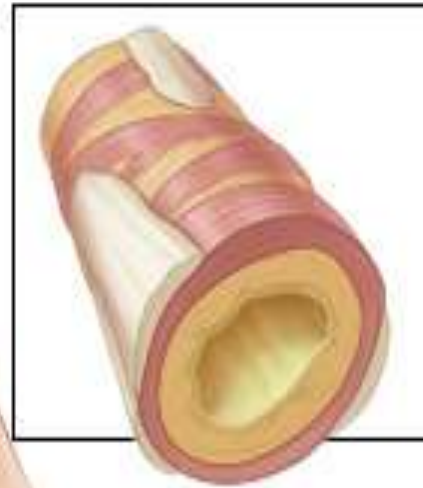
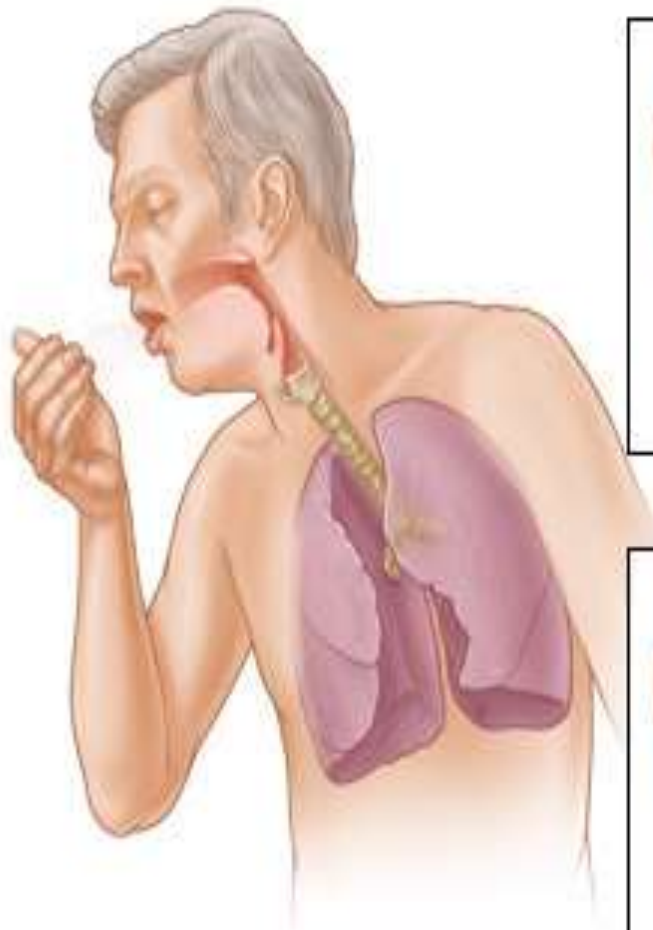


Consolidation

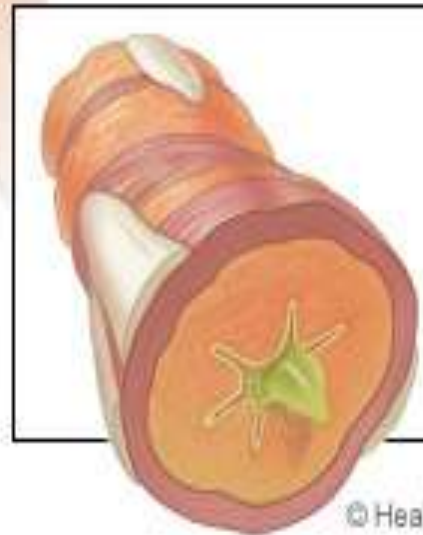
Alveoli consolidated with fluid, bacteria, RBCs, WBCs



# Bronchitis

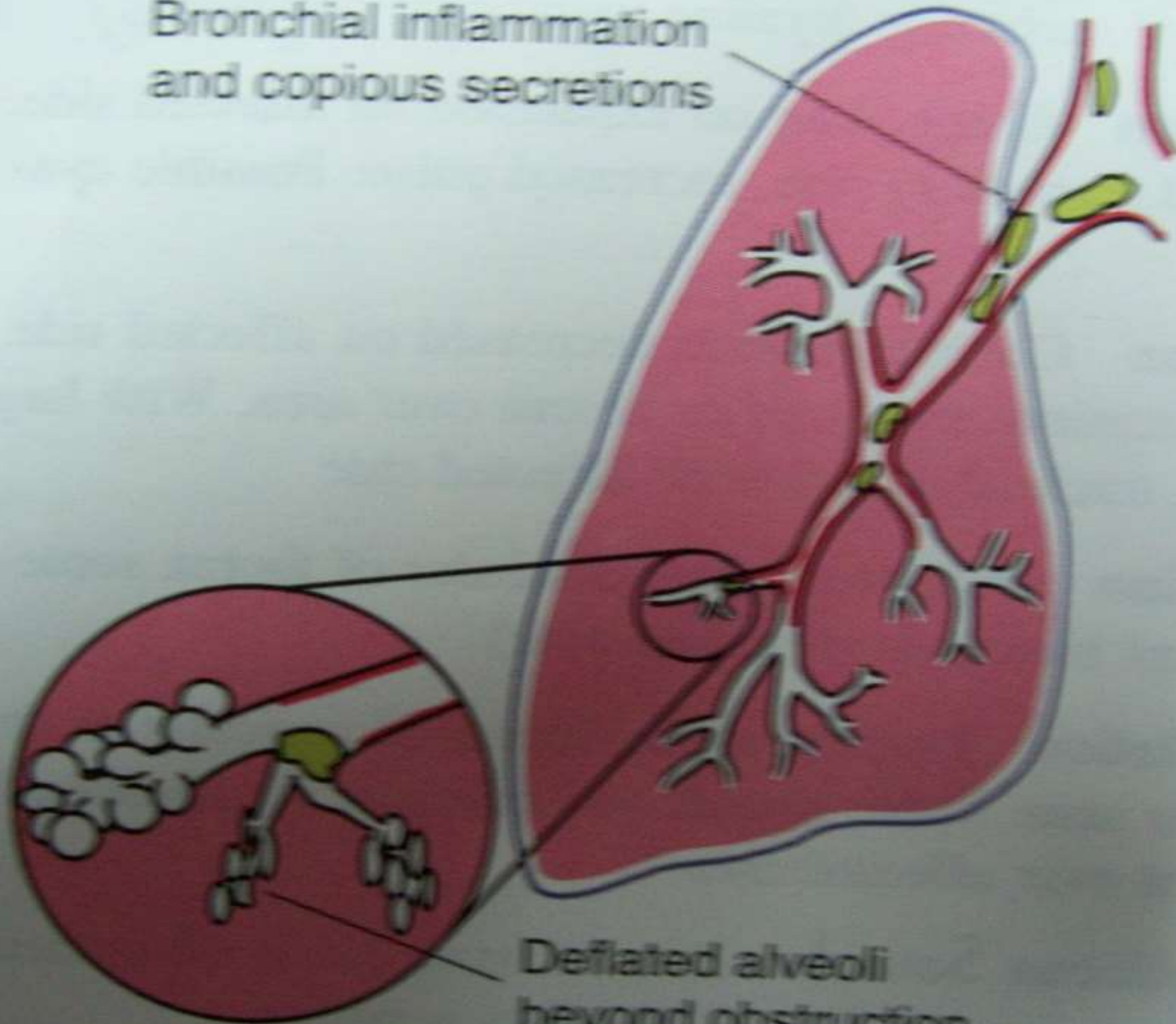


Normal  
bronchial  
tube



Inflamed  
bronchial  
tube

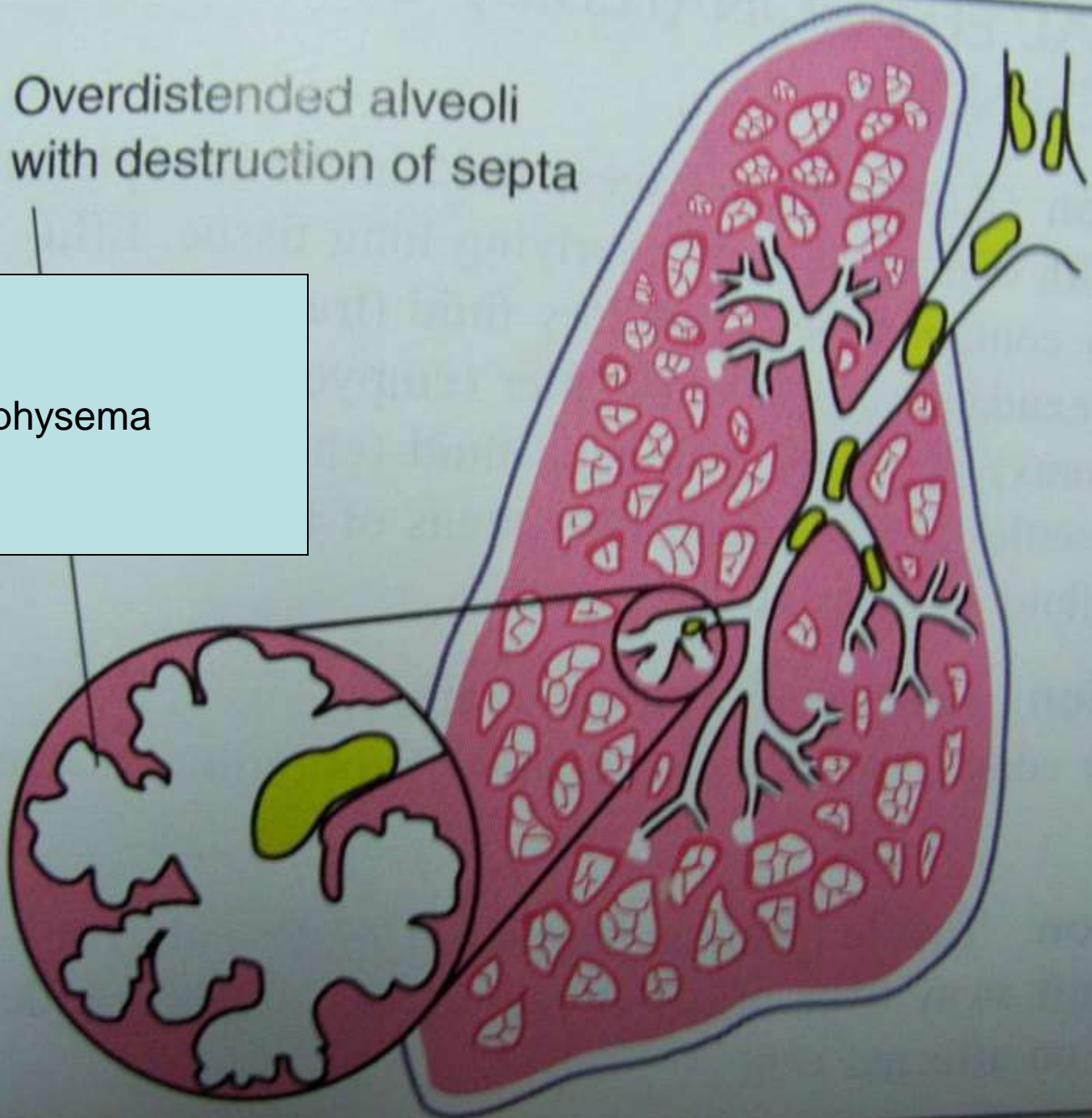
Bronchial inflammation  
and copious secretions



Deflated alveoli  
beyond obstruction

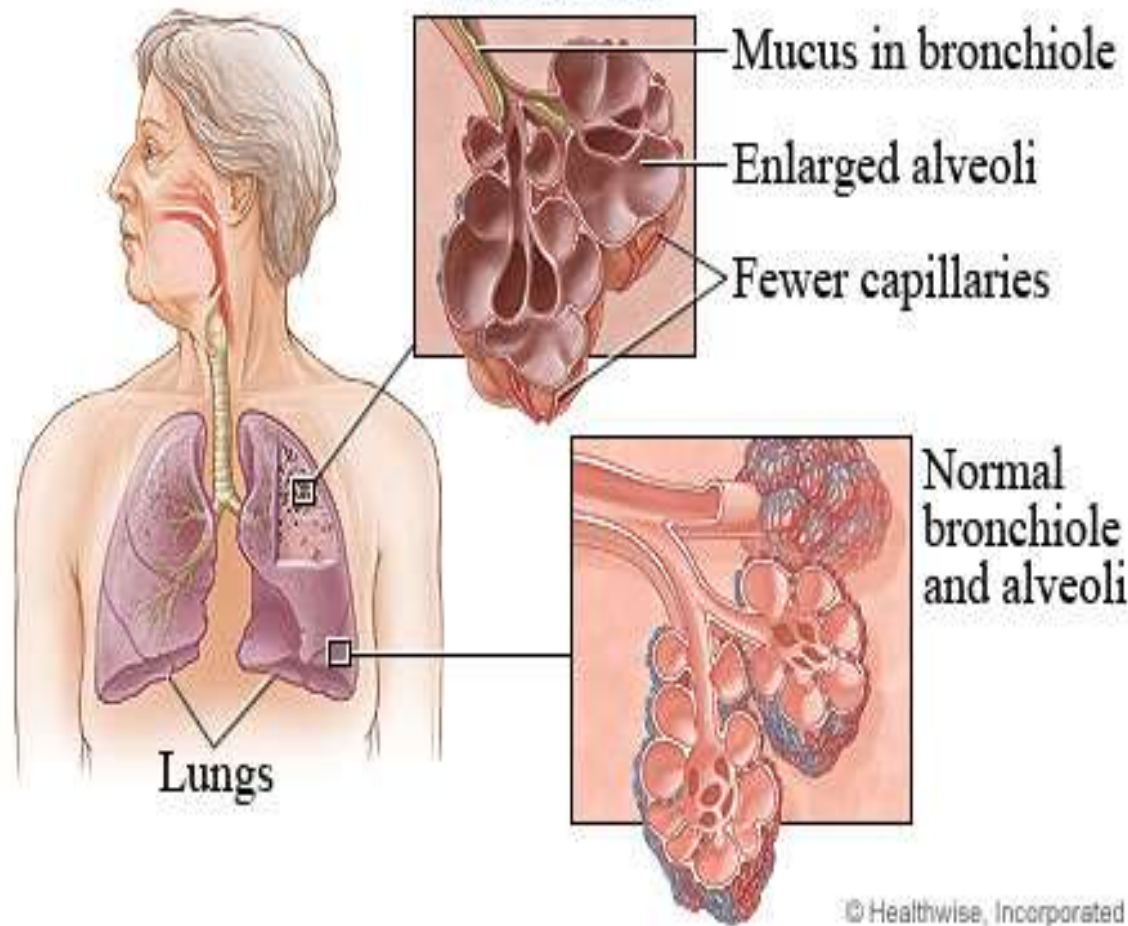
Overdistended alveoli  
with destruction of septa

Emphysema





## Emphysema



Bronchospasm

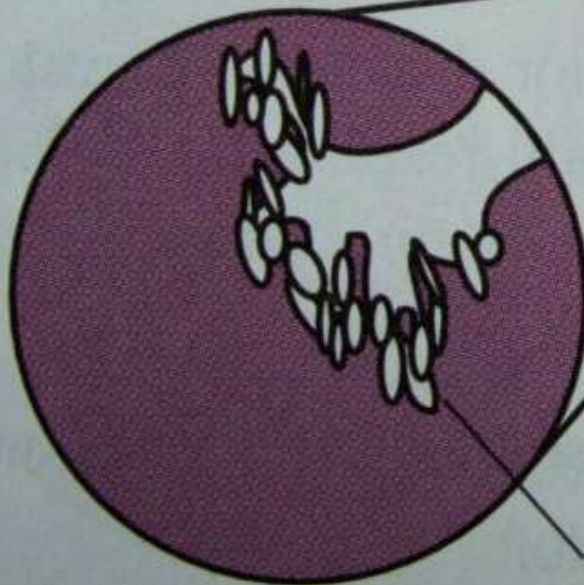
Asthma



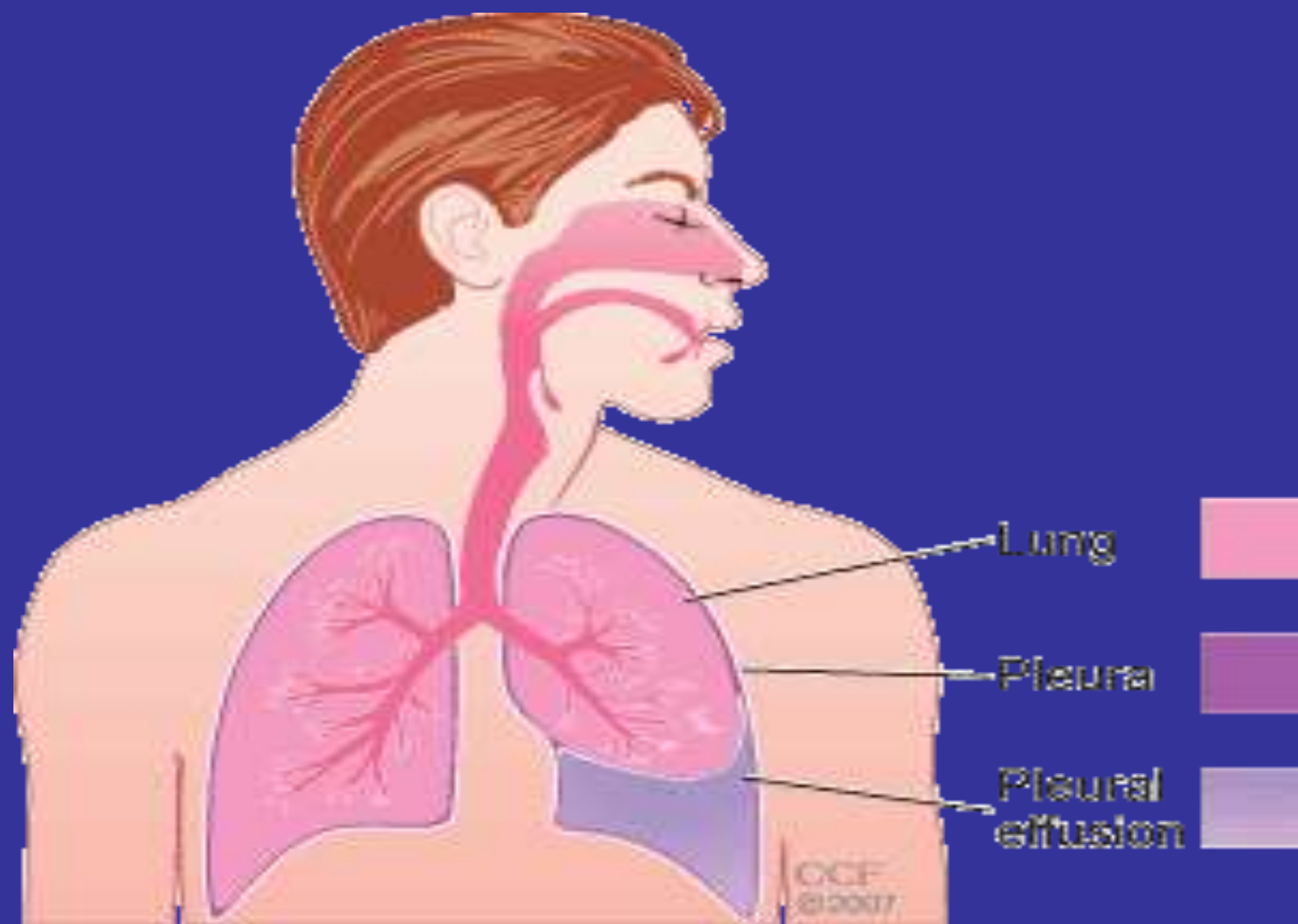
Edema of bronchial mucosa, thick mucus

Pleural Effusion

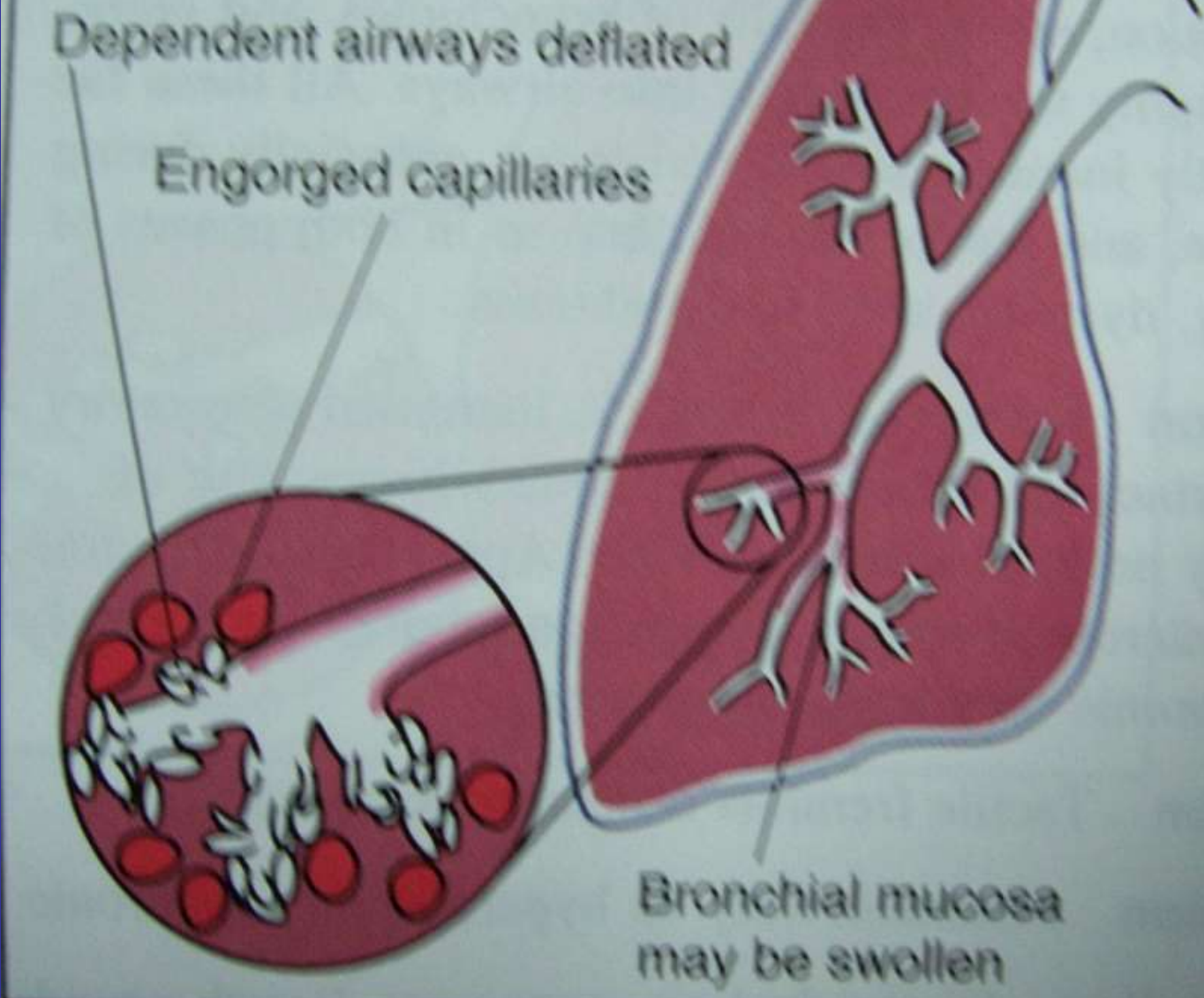
Pleural fluid

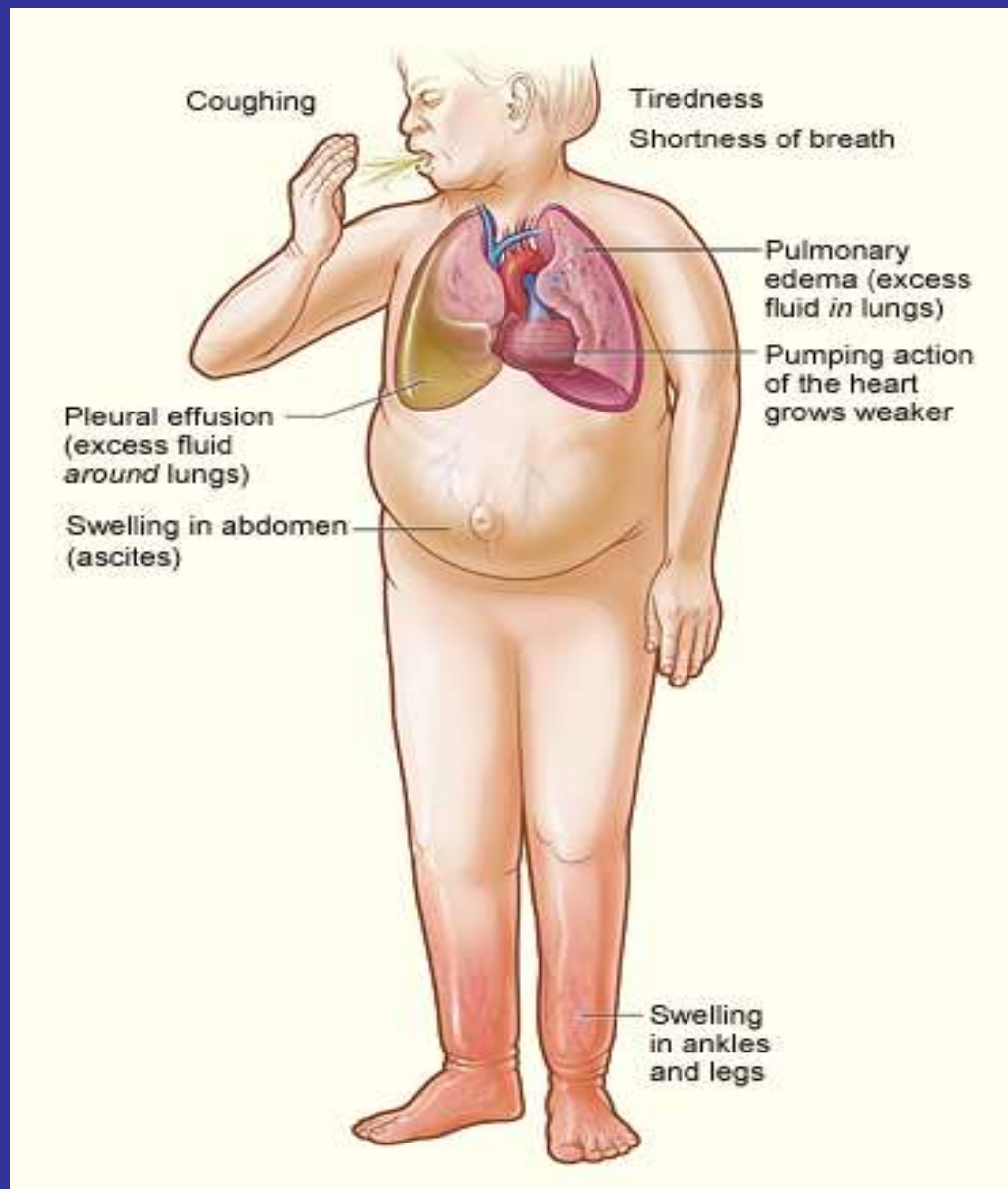


Alveoli compressed

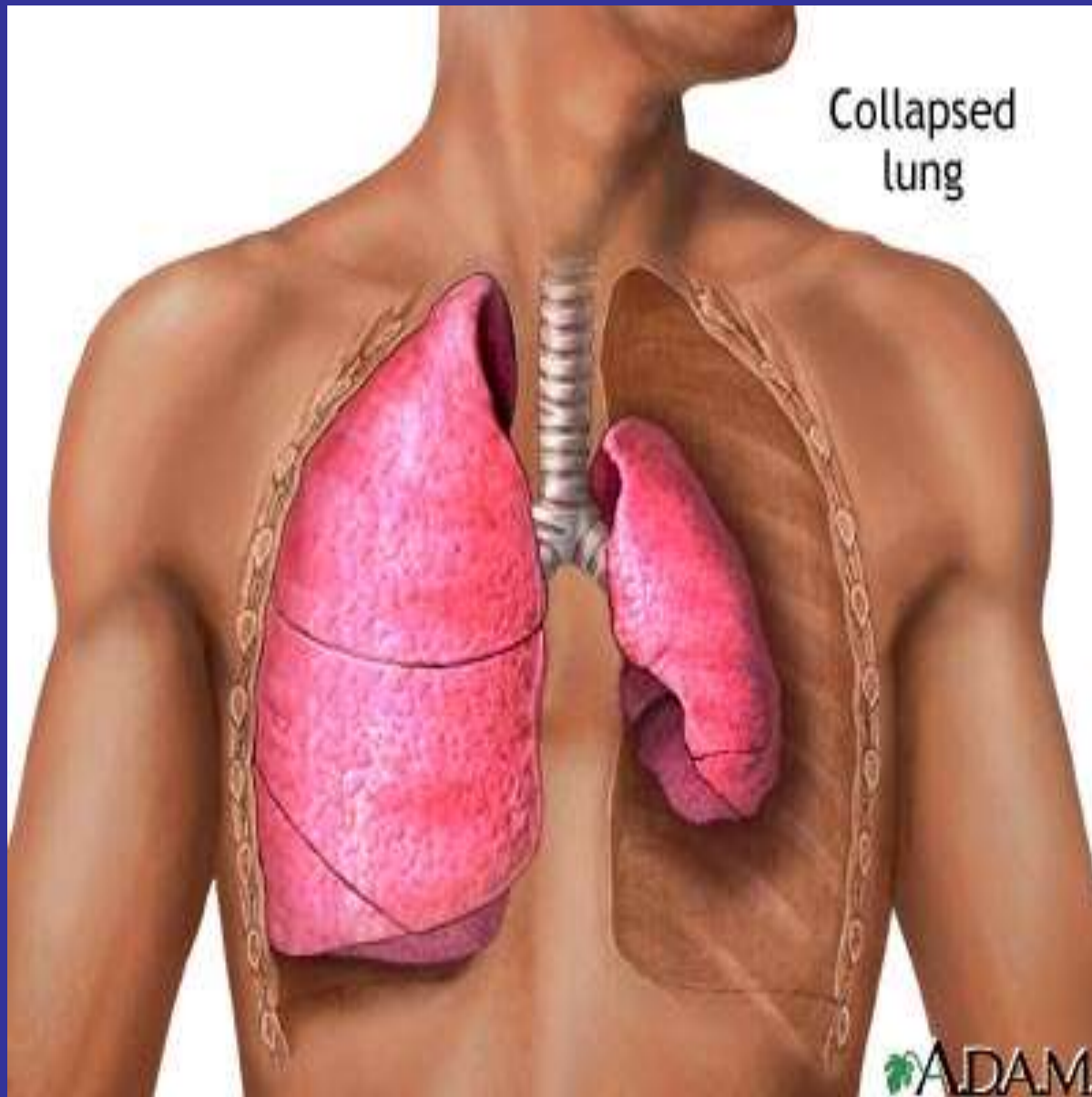


# Heart failure

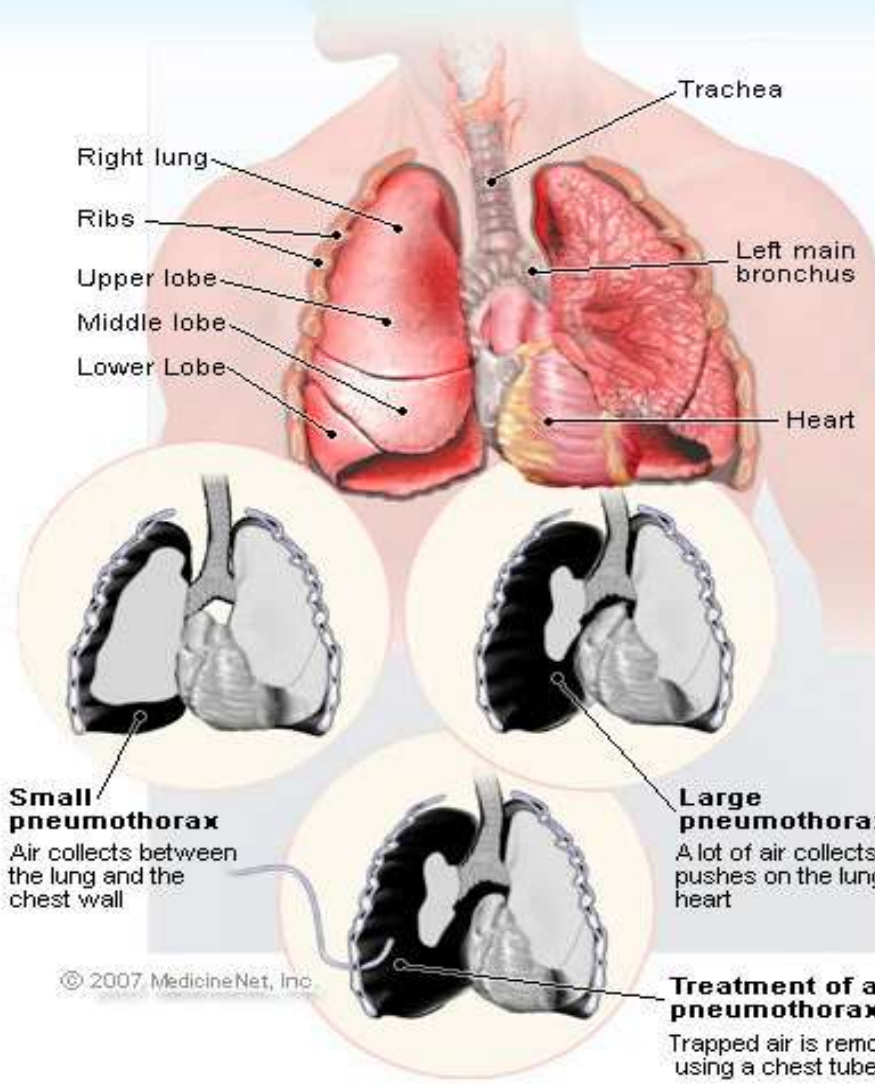




Collapsed  
lung

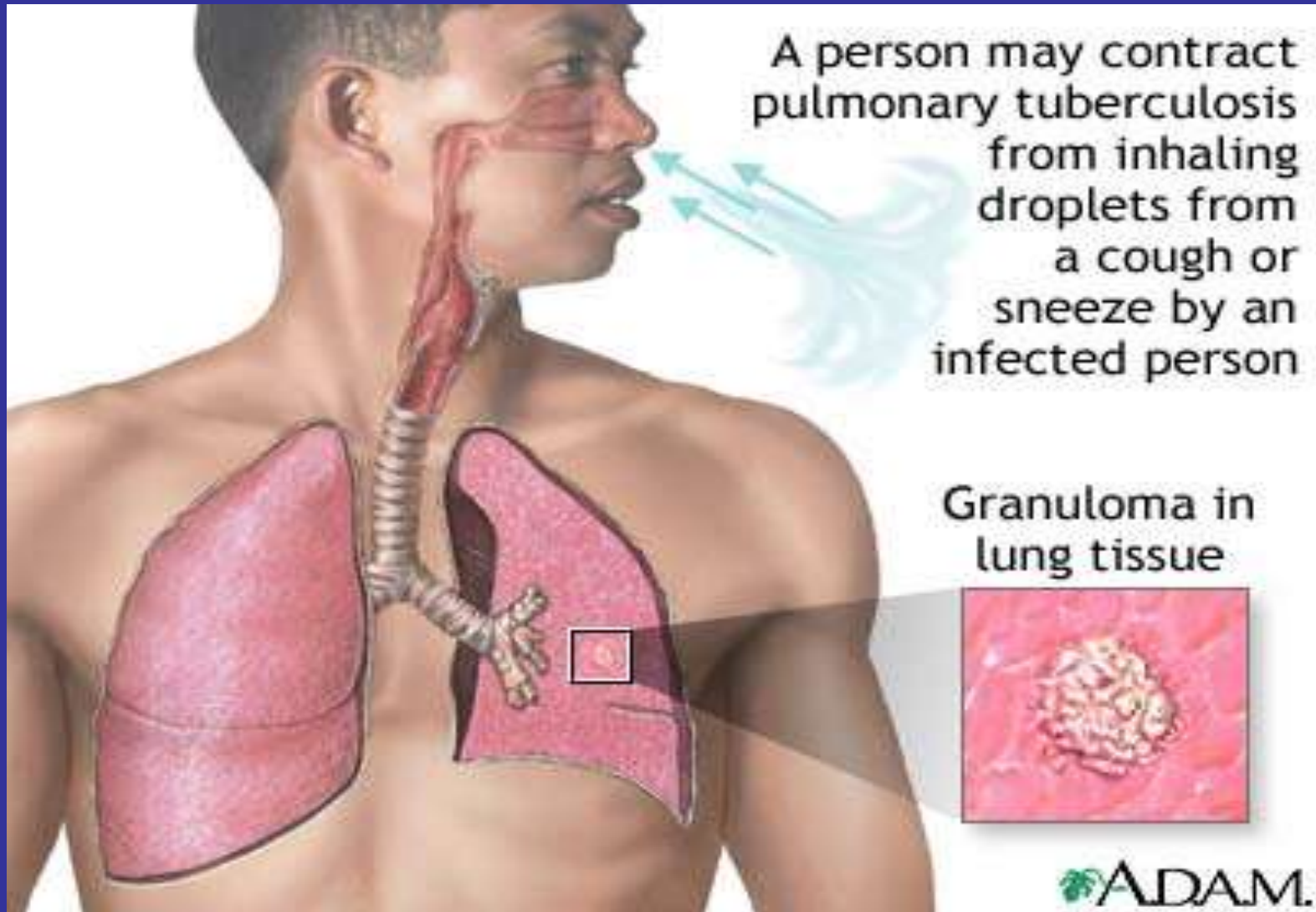


# Pneumothorax

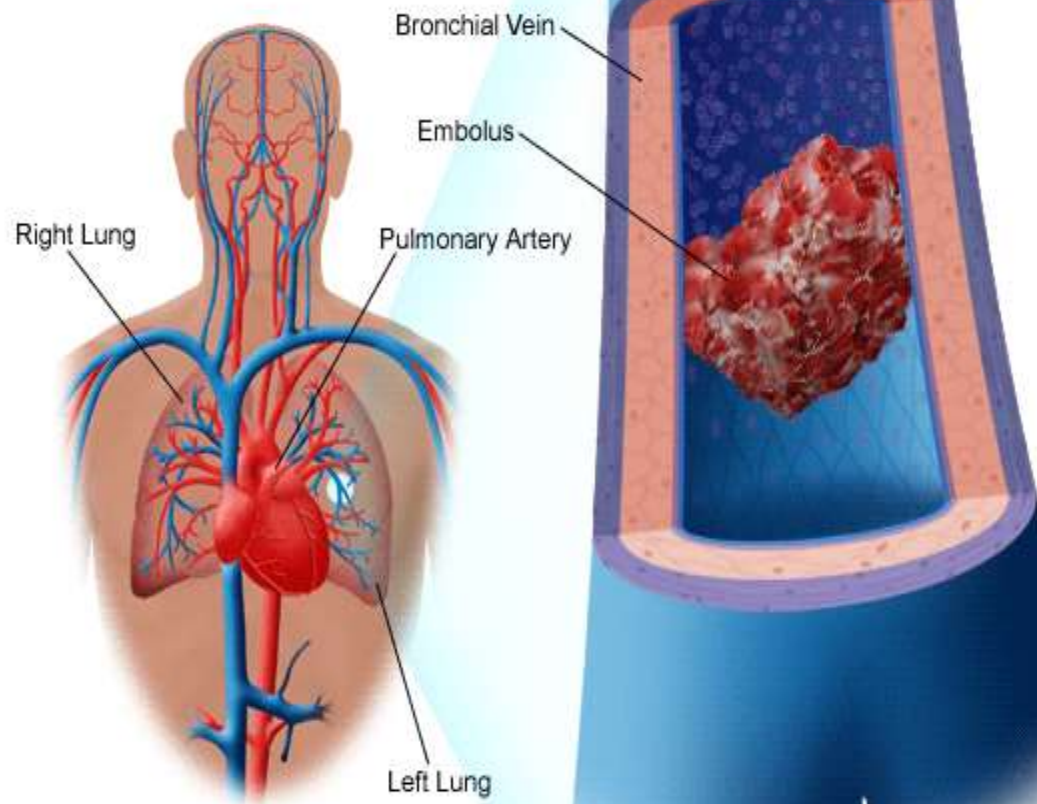




# Tuberculosis (TB)



# Pulmonary Embolism



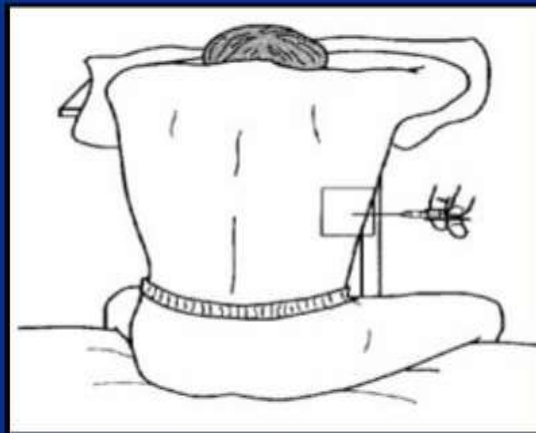
# Diagnostic procedure

# Thoracentesis

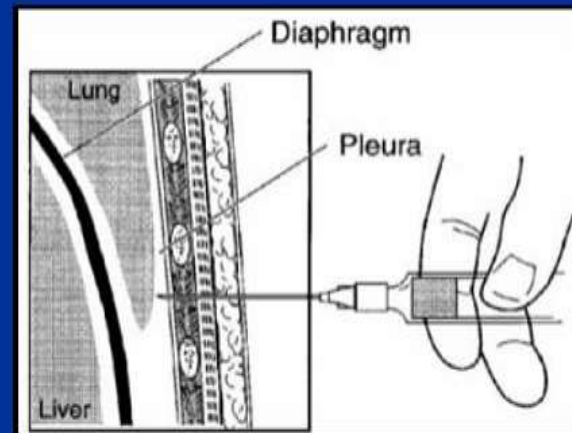
- **Thoracentesis: a procedure to remove fluid from the pleural space (space between the lungs & chest wall).**
- It is done with **a needle** inserted through **the chest wall**.
- The pleural fluid may be sent to **a lab** to determine the cause of fluid accumulation in the pleural space.
- **Normally only a small amount of pleural fluid is present in the pleural space.**
- Accumulation of excess pleural fluid (**pleural effusion**) may be caused by many conditions, such as **infection, inflammation, heart failure, or cancer.**
- A large amount of fluid is present → **difficult to breathe.**

- Fluid inside the pleural space may be found during **a physical examination** and is usually confirmed by a chest **X-ray**.
- The recommended location varies depending upon the source. Some sources recommend the **midaxillary line in the 6<sup>th</sup>, 7<sup>th</sup>, or 8<sup>th</sup> intercostal space**.

### Thoracentesis Figures: Outside and In



Inserting the needle



Between the ribs, in the space around the lung, not INTO the lung

# Left-sided Pleural Effusion



## Why It Is Done

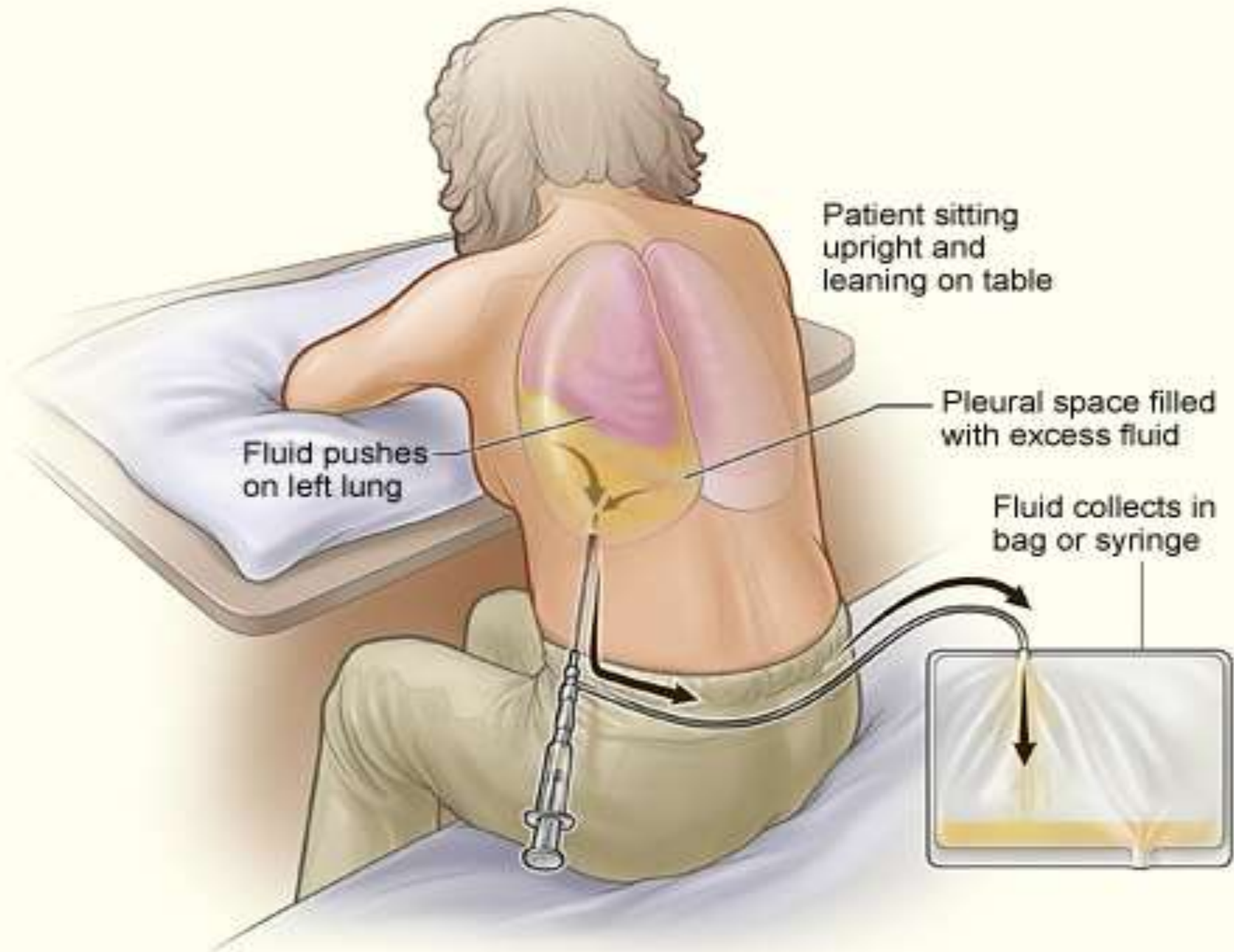
Thoracentesis may be done to:

- Determine the **cause of excess** pleural fluid (**pleural effusion**).
- **Relieve shortness of breath and pain** caused by a pleural effusion.

## How It Is Done

- During the procedure, patient will be **seated but leaning forward on a padded bedside table**. If the test is done in the **X-ray department**, **X-rays or ultrasound** may be used to confirm the location of fluid in the chest.
- The **needle site** between your ribs will be cleaned with an **antiseptic solution**.
- The doctor will give the pt. **a local anesthetic** in the chest wall so pt. won't feel any pain when the longer needle that withdraws the fluid is inserted. Once the area is numb, the doctor will insert the needle to where the fluid has collected (pleural space).





## How It Is Done continued...

- Pt may feel some **mild pain or pressure** as the needle enters the pleural space.
- A **syringe or a small tube attached to a vacuum bottle** is used to remove the pleural fluid. **The doctor collects 50mL -100mL of fluid at a time to send to the lab. Up to 1500mL may be removed** if the fluid is making it difficult to breathe.
- Once the fluid is removed, the needle or small tube is removed and **a bandage is put** on the site.

- This procedure takes about **10 to 15 minutes**.

## **After the procedure**

- **An X-ray** is usually taken right after the procedure to make sure that no **complications** have occurred. If more pleural fluid collects and needs to be removed, **another thoracentesis** may be done later.

## Risks

- Thoracentesis is **generally a safe procedure**. A chest X-ray is usually done right after the procedure to make sure that no complications have occurred.

### Complications may include:

- **A partial collapse of the lung (pneumothorax)**. This may occur if the needle used to remove the pleural fluid **punctures the lung**, allowing **air to flow into the pleural space**.
- **Pulmonary edema**, which may occur if a large amount of fluid is removed.
- **Infection and bleeding**.
- **Damage to the liver or spleen**, though this is rare.

## Results

- **Thoracentesis Normal:** A small amount of **clear, colorless, or pale yellow pleural fluid**, usually **less than 20mL**, is normally present. No infection, inflammation, or cancer is found.
- **Abnormal:** A large amount of pleural fluid is present. A **transudate or an exudate** fluid. These two types of fluid differs in the amount of protein and other substances found in the fluid.
  - 1 -**A transudate** has a **low white blood cell (WBC) count, a low lactate dehydrogenase (LDH) enzyme level, and a low protein level.** It may be caused by **cirrhosis, heart failure, or nephrotic syndrome.**
  - 2 -**An exudate:** caused by diseases, such as **infection (pneumonia), chest injury, cancer, pancreatitis, autoimmune disease, or a pulmonary embolism (PE).**

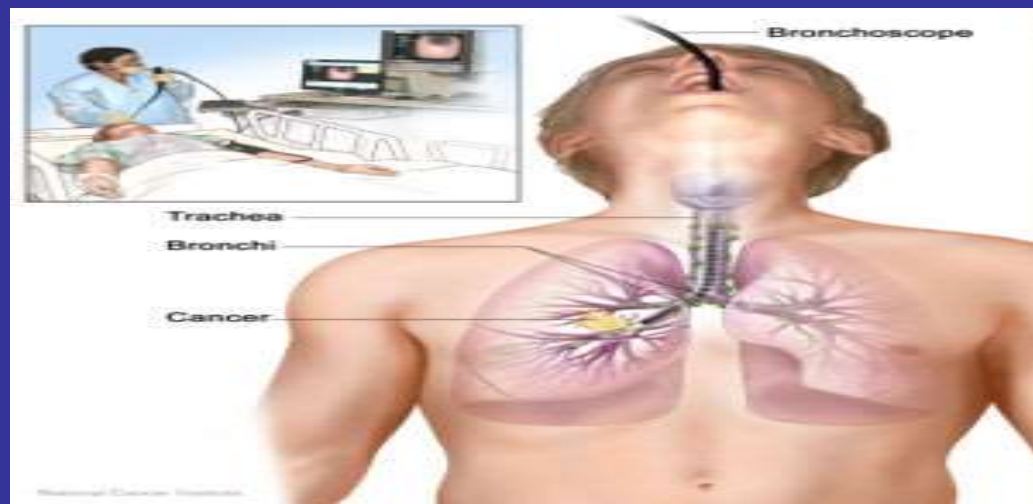
- \* - If an **infection** is present, the exudate will have a high WBC count, a high LDH enzyme level, a high protein level, and **bacteria or other infectious organisms**.
- \* - If **cancer** is present, the exudate will have a high WBC count (often lymphocytes), a high LDH enzyme level, and a high protein level. **Abnormal cells may also be present.**
- If a **pulmonary embolism** is present, the exudate will have a low WBC count and high red blood cell count. The protein level may be high or low.

# Bronchoscopy

- Bronchoscopy is a procedure in which a hollow, flexible tube is inserted into the airways (nose or mouth).
- The bronchoscope is inserted through the nose (or mouth)
  - provides **a view of the** tracheobronchial tree
  - to **collect** bronchial and/or lung **secretions**.
  - **Tissue biopsy** may also be performed via the bronchoscope.

# Purpose

- During a bronchoscopy, the physician can visually examine the **lower airways**, including the larynx, trachea, bronchi, and **bronchioles**. The procedure is used to examine the **mucosal surface** of the airways for abnormalities that might be associated with a variety of lung diseases.
- It may be **diagnostic or therapeutic**.





Bronchoscopy: used to **examine/diagnose**:

- **diseases of lung (e.g. cancer or tuberculosis)**
- **a congenital deformity of lungs**
- **a suspected tumor, obstruction, secretion, bleeding or foreign body in the airways**
- **airway abnormalities (e.g. tracheal stenosis)**
- **a persistent cough, or hemoptysis, a cough that includes blood in the sputum**

Bronchoscopy: used for **therapeutic purposes**:

- to remove a **foreign body** in the lungs
- to remove **excessive secretions**

■  
Bronchoscopy can also be used to collect the following specimens:

- sputum
- tissue samples from the bronchi or bronchioles
- cells collected from washing the lining of the bronchi or bronchioles

## Preparation

- The patient should **fast for six to twelve hours** prior to the procedure and refrain from drinking any liquids the day of the procedure. Smokers should refrain from smoking for 24 hours prior to the procedure. The bronchoscopy itself takes about 45-60 minutes. Prior to the bronchoscopy, several tests will be done, including chest x ray and blood work.
- Sometimes a bronchoscopy is done under **general anesthesia**, in which case the patient will have an intravenous (i.v.) line in the arm. More commonly, the procedure is performed under **local anesthesia**, which is sprayed into the nose or mouth.
- This is necessary **to inhibit the gag reflex**. A **sedative** may be given. It is important that the patient understands that at no time will the airway be blocked and that oxygen can be supplied through the bronchoscope. A signed consent form is necessary for this procedure.

## Aftercare

- After the bronchoscopy, the **vital signs** (heart rate, **blood pressure**, and breathing) are monitored. Sometimes patients have an abnormal reaction to anesthesia. Any sputum should be collected in an emesis basin so that it can be examined for the presence of blood.
- If a biopsy was taken, the patient should not cough or clear the throat as this might dislodge any blood clot that has formed and cause bleeding. **No food or drink should be consumed for about two hours** after the procedure or until the anesthesia wears off.
- There is a significant risk for choking if anything (including water) is ingested before the anesthetic wears off, and the gag reflex has returned.

- To test if **the gag reflex has returned**, a spoon is placed on the back of the tongue for a few seconds with light pressure. If there is no gagging, the process is repeated after 15 minutes. No small or sharp objects are used to test this reflex. The gag reflex should return in one to two hours. Ice chips or clear liquids should be taken before the patient attempts to eat solid food.

- The patient should be instructed that after the anesthetic wears off the throat may be irritated for several days.
- Patients should **notify their health care provider** if they develop any of these symptoms:
  - **hemoptysis** (coughing up blood)
  - **shortness of breath, wheezing or any trouble breathing**
  - **chest pain**
  - **fever**, with or without breathing problems

## Results

- **Normal tracheal** appearance consists of smooth muscle with **C-shaped rings** of cartilage at regular intervals. The trachea and the bronchi are lined with **a mucous membrane**.
- **Abnormal bronchoscopy** findings include **deformity in the bronchial wall**, such as inflammation, stenosis or compression of the trachea, neoplasm, and foreign bodies.

- Findings of **swelling, or ulceration** are abnormal.
- The bronchoscopy may also reveal the presence of **atypical substances in the trachea and bronchi**. If samples are taken, the results could indicate cancer, disease-causing agents or other lung disease.
- Other abnormalities include constriction or **narrowing (stenosis), compression, dilation of vessels, or abnormal branching** of the bronchi.
- **Abnormal substances** that might be found in the airways include blood, secretions, or mucous plugs. Any abnormalities are discussed with the patient.



# Health care team roles

- The test is usually performed by a pulmonologist, a physician specializing in diseases of the lungs. Nursing staff assist with providing **education, monitoring the patient, and conducting tests**, including checking blood pressure, pulse, and respiratory rate prior to the patient's discharge.

# Chest X Ray

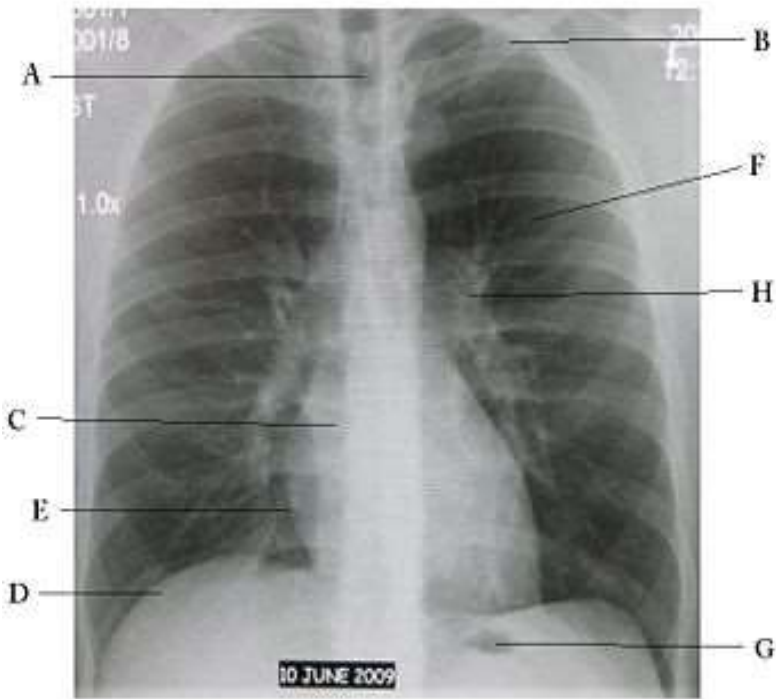
- **X ray:** A form of **electromagnetic radiation** with **shorter wavelengths** than normal light. X rays can penetrate most structures of the body and produce an image on an x-ray film. Another name for x ray is **radiograph**.
- A chest x ray is a procedure used **to evaluate organs and structures within the chest for symptoms of disease**. Chest x rays include views of the **lungs, heart, small portions of the gastrointestinal tract, thyroid gland and the bones of the chest area..**

## Pulmonary disorders

- Chest films are frequently ordered to diagnose or rule out:
  - Pneumonia, shows up on radiographs as patches and irregular areas of density (from fluid in the lungs .(
  - Emphysema: Widening of the spaces between ribs.
  - Shifts or shadows in the hila (lung roots) may indicate emphysema or a pulmonary abscess.
  - Pneumothorax: (presence of air or gas in the chest cavity outside the lungs) may be detected or evaluated through the use of chest x ray.

## Description

- Routine chest x rays consist of **two views**:
  - **Frontal view** (referred to as posterioranterior or PA).
  - **Lateral (side) view**: preferred that the pt stand for this exam, particularly when studying collection of fluid in the lungs.
- During the actual time of exposure, the technologist will ask the **pt to hold his/her breath**. The procedure will only take **a few minutes** and the time ps must hold their breaths is a matter of a **few seconds**.



**Normal chest x-ray.**

**A=Airway;  
B=Bone,  
C=Cardiac,  
D=Diaphragm,  
E=Edge of the heart,  
F=Field of lung,  
G=Gastric bubble,  
H=Hilum of lung**

# Interpretation of the X-Ray

- **Air** appears black,
- **fat** appears gray,
- **soft tissues and water** appear as lighter shades of gray,
- **bone and metal** appear white.
- The **denser the tissue**, the whiter it will appear on x-ray.

# Pulmonary Function Tests

- Pulmonary function tests are tests performed to **make measurements of how your lungs and airways function**. Results from pulmonary function tests enable your physician **to evaluate breathing, make diagnosis, recommend treatment and follow progress**.



## Performing the test

- Pt seated in the booth with mouth on the mouthpiece and noseclips on the nose.
- Pt **breathe normally** and then a shutter will close. The **shutter is closed for a second** while pt **continue to breathe normally** against the shutter
- The **shutter opens**, and after breathing normally pt will be asked **to slowly blow out until his/her lungs are empty**
- Then pt will **take a big deep breath** in filling up his/her lungs completely



- As soon as pt's lungs are full, pt will **blow out as hard and as fast** as he/she can until lungs are absolutely empty
- Pt will then take **a breath in and come off of the mouthpiece**
- The door will be opened until pt is ready to do another effort
- Pt will be asked to repeat the test until there are three good efforts, which are reproducible

■  
*This test allows us to measure:*

- **Lung volumes** - Thoracic Gas Volume (TGV) / Functional Residual Capacity (FRC)
- Total lung capacity (TLC)
- Expiratory reserve volume (ERV)
- Inspiratory capacity (IC)
- Inspiratory reserve volume (IRV)
- Residual volume (RV)
- Airways resistance (Raw/Sgaw)
- **Spirometry at absolute lung volumes (FVC, FEV1)**

# Lung Volumes & Capacities

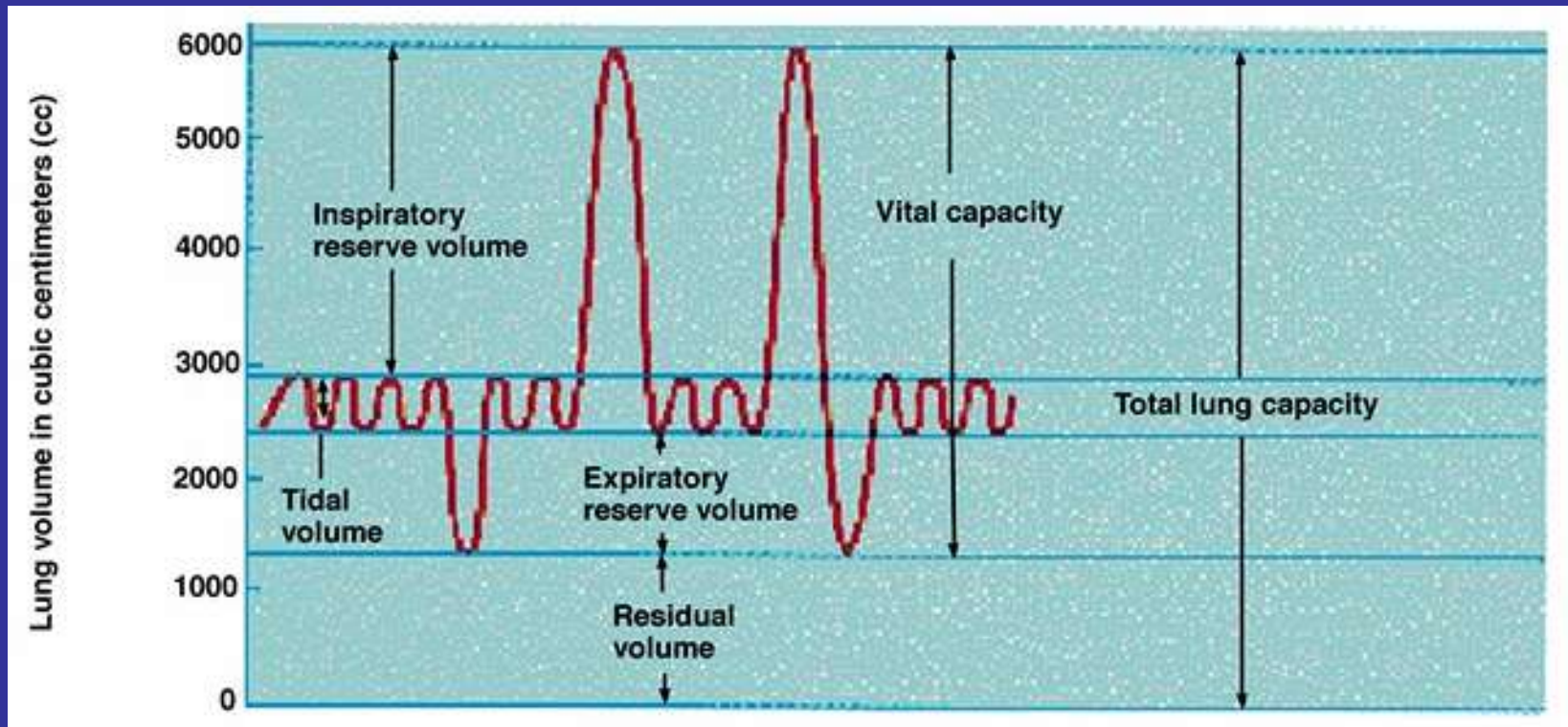
- **Tidal volume (TV)**: air volume of each breathe.
- **Inspiratory reserve volume (IRV)**: maximum volume that can be inhaled after a normal inhalation.
- **Expiratory reserve volume (ERV)**: maximum volume that exhaled after a normal exhalation.
- **Capacities**
  - **Forced vital capacity (FVC)**: VC performed with a maximally force expiratory effort.
  - **Forced expiratory volume (FEV)**: volume exhaled forcefully over time in seconds. Time is indicated as a subscript, usually 1 second.

# Pulmonary Capacities

Sum of two or more pulmonary volumes:

- **Inspiratory capacity**- tidal volume + inspiratory reserve
- **Functional residual capacity**- expiratory reserve volume + residual volume
- **Vital capacity**- inspiratory reserve + tidal volume + expiratory reserve
- **Total lung capacity**- vital capacity + residual volume

# Lung Function



Good Luck

