



# RS

## ANATOMY

MODIFIED NO. 5 part 1



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# Trachea and lungs (1)

## Color code

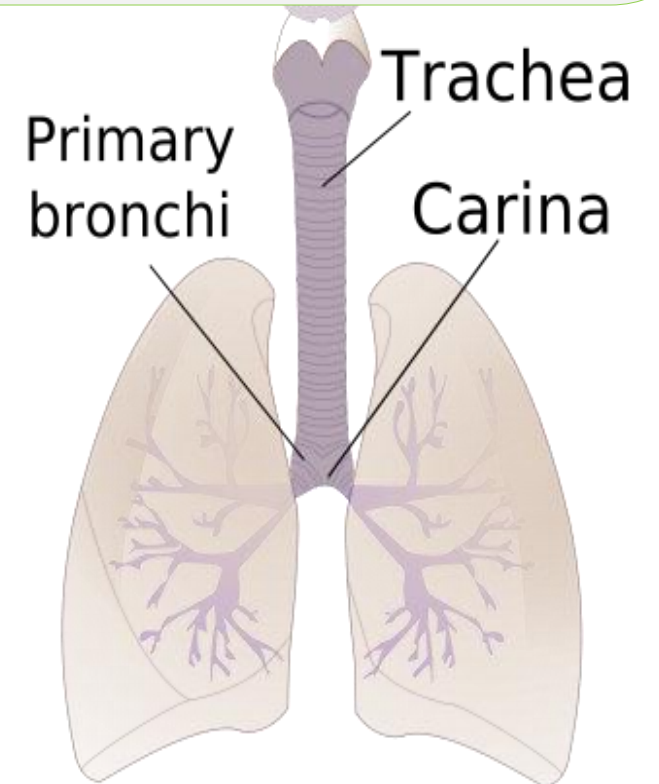
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	Slides
	Doctor
	Additional info
	Important

# Trachea

- The **trachea** is a flexible tube that extends from vertebral level CVI (cricoid cartilage ) in the lower neck to vertebral level TIV/V
- It extend below the lower boarder of the cricoid cartilage to the area between T4 & T5
- it bifurcates into a right and a left main bronchus (carina) at the level of sternal angle
- The trachea is held open by 'C-shaped' cartilage rings (16-20) embedded in its wall-
- the open part of the 'C' facing The posterior wall of the trachea is composed mainly of smooth muscle (trachealis) and connective tissue.
- In adults the trachea is about 4½ in. (11.25 cm) long and 1 in. (2.5 cm) in diameter (about our index) BUT in children it's very narrow (diameter of the pencil) => So tracheostomy is easier in adults
- The trachea widens and lengthens slightly with each inspiration, returning to its resting size with each expiration.

- This cartilage is important to keep trachea open for air passage
- Why is it C-shape not complete circle? Since esophagus is posterior to trachea. Its function is to pass the bolus downward
- Trachealis muscle is located between trachea and esophagus and it help passage of bolus



## Notes about the previous slide

- Let's talk about Carina,
- **Definition** : it is a ridge of cartilage covered by mucosa
- **Location** : lies between the bifurcation of Rt. & Lt. Main bronchus
- **Clinical importance** : It's very sensitive (specifically its mucous membrane), that's why surgeons try their best to not touch it during bronchoscopy, if they touch it => this will cause cough reflux, which affect the operation.
- **Changes During deep inspiration** : it descends to T6 then it return to T4 after inspiration

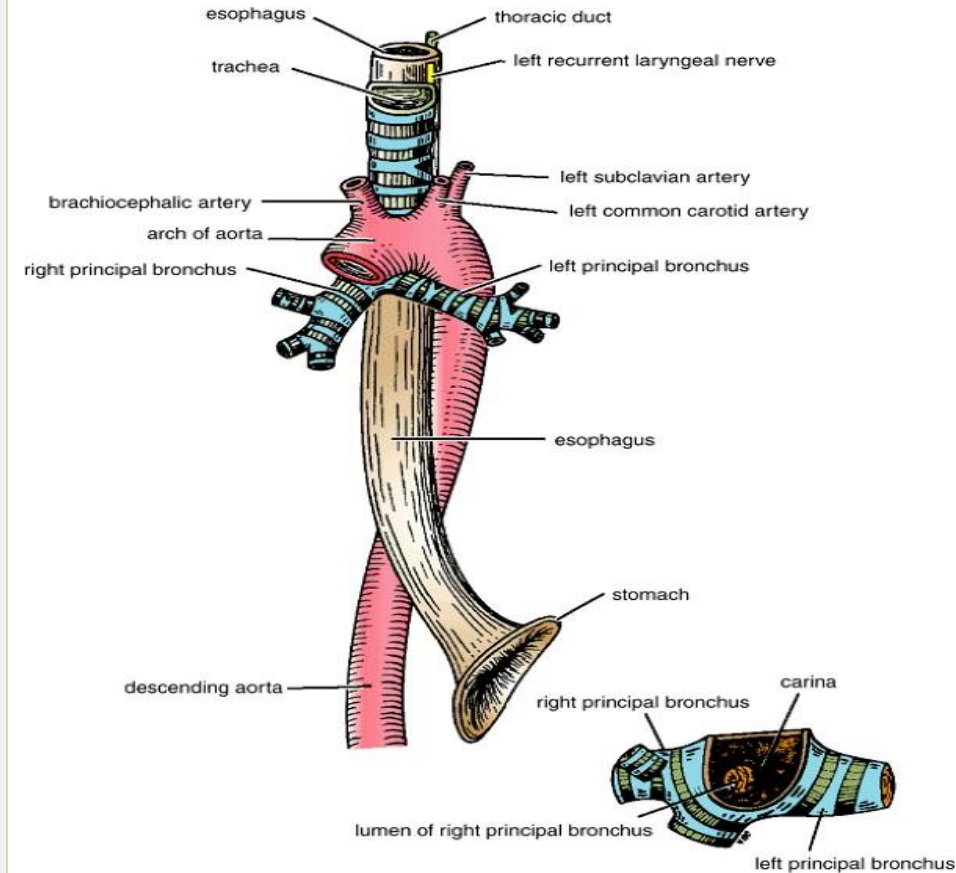


## Anteriorly

- Aortic arch
- Thymus (accurately, the remnant of it, rudimentation of it occur in adults)
- Thyroid (isthmus , which is in front of 2,3&4 tracheal rings
- Origin of brachiocephalic artery
- Manubrium sterni

## Post.

- Esophagus
- Thoracic duct (lymphatic vessels) (it starts at cisterna chyli, at the opening of abdominal aorta, right to the abdominal aorta. It ascends upward right to the esophagus, at T5 it become posterior to it. So it pass posterior to both esophagus and trachea to the left side to drain in the beginning of Lt.brachiocephalic vein )
- left recurrent laryngeal nerve (recurrent nerve only at left side NO at right side since right originates at the root of the neck , below subclavian artery !!) (<https://youtu.be/ama7tzVREpl?si=4Zk0GjTf07tLKBci>)



- **The right recurrent laryngeal nerve is posterior to trachea in general but it is more lateral to esophagus.**

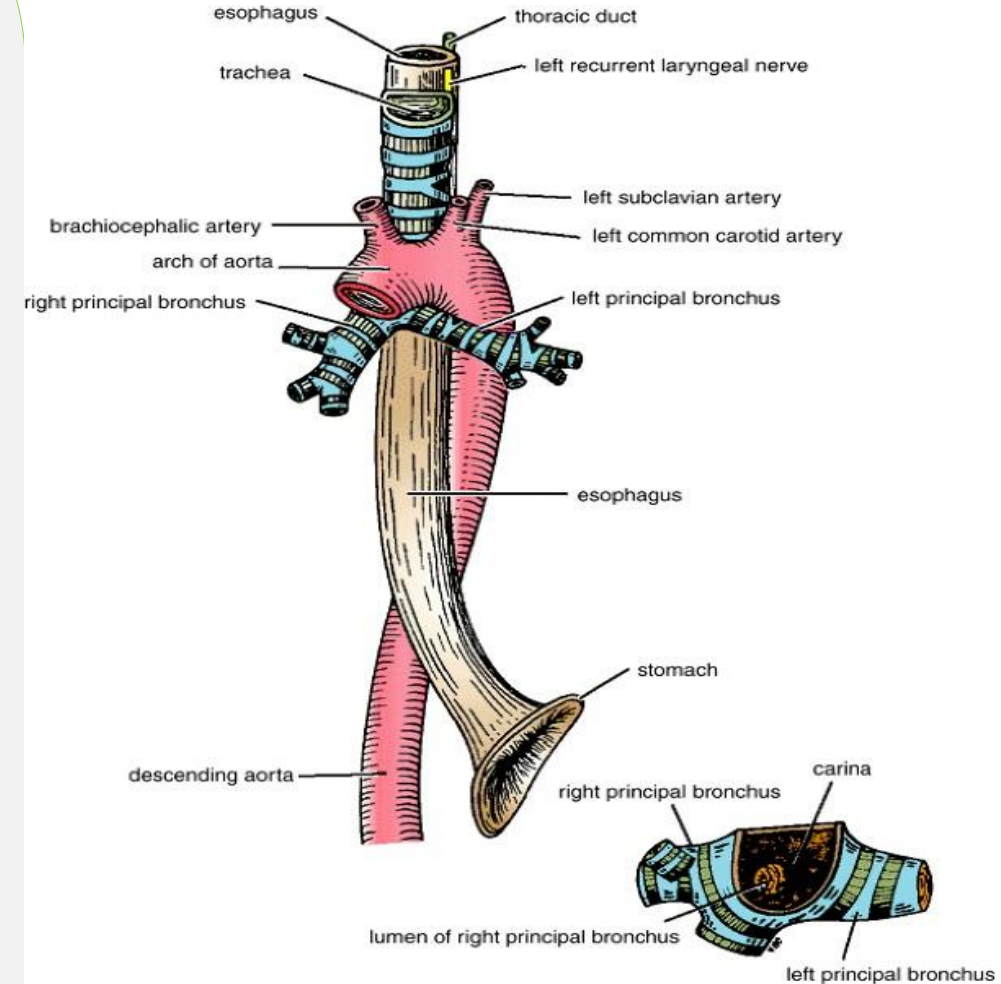


## Right

- Azygous arch (the end of Azygos vein, Above the hilum of Rt.Lung, ends at SVC)
- Brachiocephalic artery (it starts anteriorly then continue to the right side, it divides into Rt. Common carotid & Rt. subclavian)
- Rt. Vagus (usually passes **behind** the hilum of the lung)
- Rt. Phrenic (usually passes **Anterior** to the hilum of the lung)
- Rt.main bronchus

## Left

- Arch of aorta
- Descending thoracic aorta
- Lt. subclavian art. => branch of the arch of the aorta
- LT. common carotid art.=> branch of the arch of the aorta
- Lt.Phrenic n.(usually passes **Anterior** to the hilum of the lung)
- Lt. Vagus n. (usually passes **behind** the hilum of the lung)
- Lt. main bronchus



# Relations of Trachea

- Everything was mentioned earlier

## Anteriorly

- Aortic arch
- Thymus
- Thyroid
- Origin of brachiocephalic artery
- Manubrium sterni

## Left

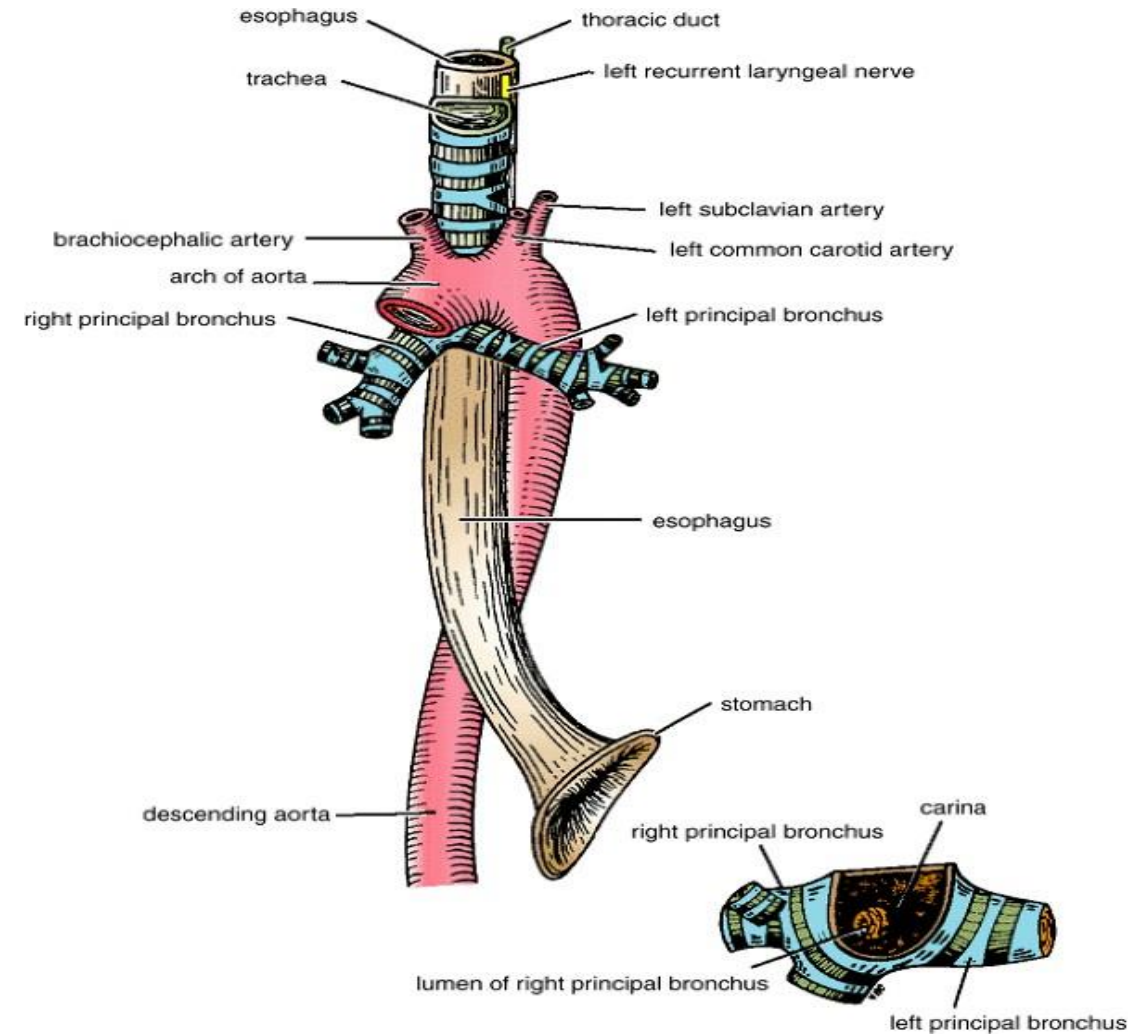
- Arch of aorta
- Lt. subclavian art.
- Lt. common carotid art.
- Lt. Phrenic n.
- Lt. Vagus n.
- Lt. main bronchus

## Right

- Azygous arch
- Brachiocephalic artery (
- Rt. Vagus
- Rt. Phrenic
- Rt. main bronchus

## Post.

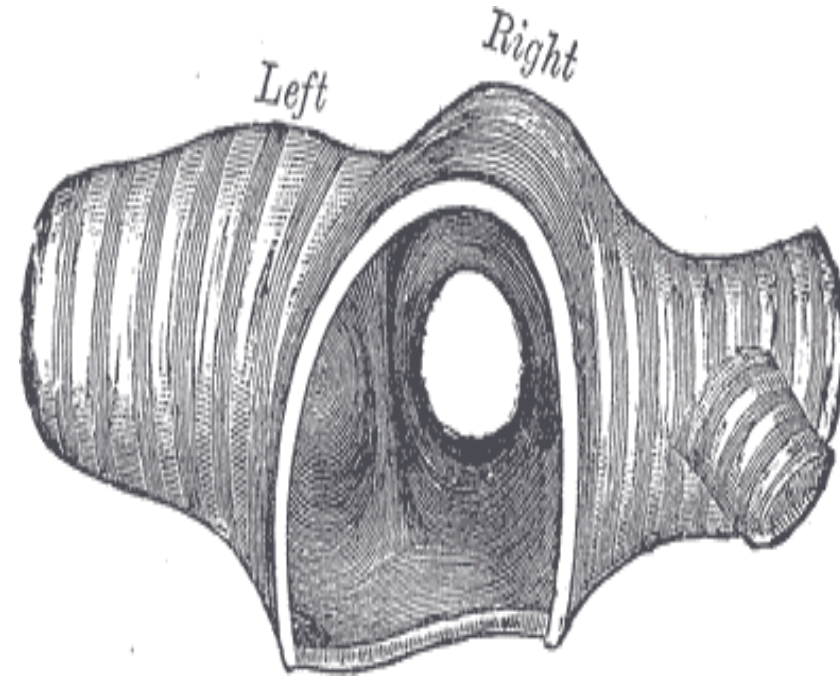
- Esophagus
- Thoracic duct
- left recurrent laryngeal nerve



# Trachea

- Everything was mentioned earlier

- **carina** is a cartilaginous ridge within the [trachea](#) that runs anteroposteriorly between the two primary [bronchi](#) at the site of the tracheal bifurcation (T4-T5).
- The mucous membrane of the carina is the most sensitive area of the trachea and larynx for triggering a cough reflex.
- **In deep inspiration it descends to the level of 6<sup>th</sup> thoracic vertebra**



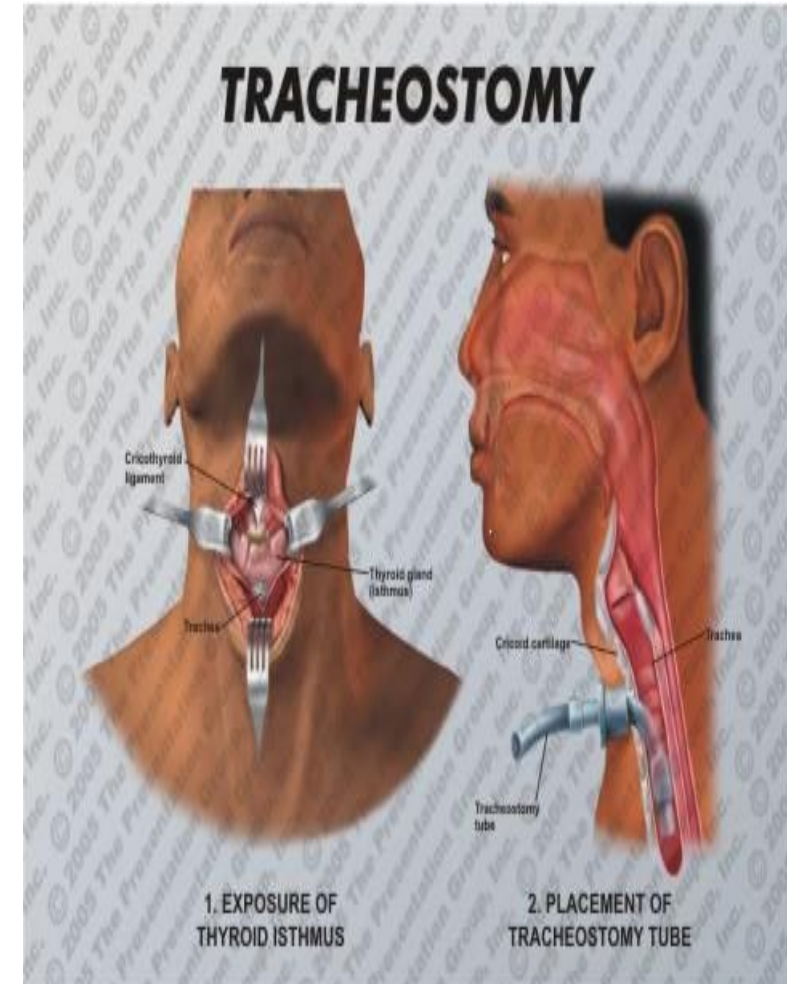


## • Intubation & Tracheotomy

- Patients in operation room after ansthesing them, we intube them How?
- By inserting endotracheal tube from their oral cavity or the nose , then to inlet of larynex then between true vocal cords to trachea
- This procedure is safe because it prevents adduction of the true vocal cords and if it occurs the tube is between them.
- Sometimes as in cancer of the larynex, which cause damage of larynex, we should do permenant intubation through the larynex to trachea, so patient can breathe through this tube. Patient clean it frequently
- While Tracheotomy :
  - 1- emergency (suprasternal) with risk of bleeding
  - 2- surgical (cricotracheal ligament OR between 1<sup>st</sup> & 2<sup>nd</sup> rings OR circothyroid ligament)
- Surgical tracheostomy between 2<sup>nd</sup> & 3<sup>rd</sup> rings is not allowed because of thyroid ismthus location there
- Also NOT allowed in thyrohyoid ligament because it is above the true vocal cords. كأنك يا أبو زيد ما غزيت
- Keep in mind we want the tracheostomy below the vocal cord

# Tracheotomy and intubations

- Used to reestablish airflow past a tracheal obstruction.
- If the obstruction is superior to the larynx a tracheotomy may be performed
- A longitudinal incision below the cricoid cartilage
- The patient can breathe through a metal or plastic tube.
- in intubation the tube is inserted through the mouth or nose and push aside any flexible obstruction
- Any mucous clogging can be suctioned through the tube



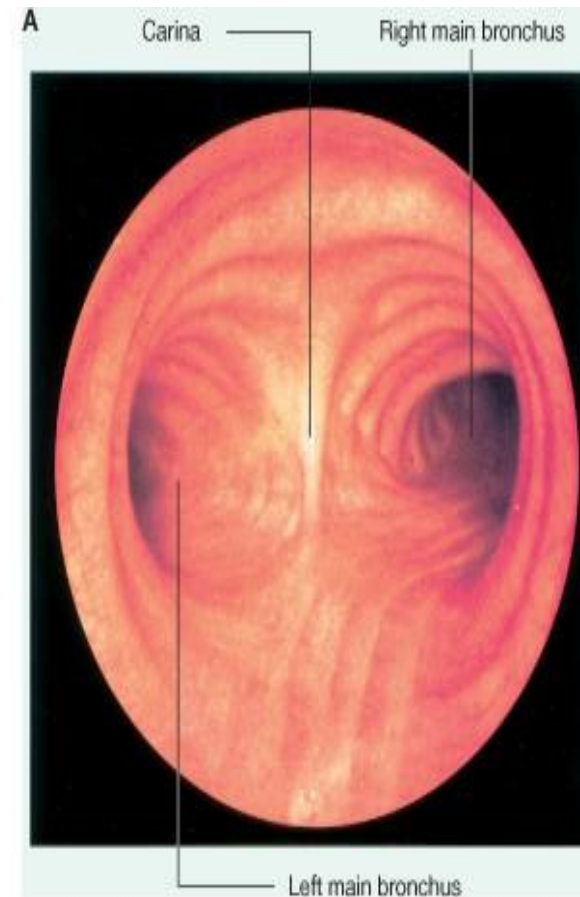
	<b>Rt.main bronchus</b>	<b>Lt.main bronchus</b>
<b>Length</b>	<b>Shorter (1 inch)</b>	<b>Longer (2-3 inches)</b>
<b>diameter</b>	<b>Wider</b>	<b>Narrower</b>
<b>Position</b>	<b>More verticle</b>	<b>More horizontal</b>

- **CLINICAL APPLICATION:** **Rt.main bronchus** is the site where forgein bodies go due to its verticle position, its wider lumen & short length and more verticle.
- **Recall** => Main bronchus = extrapulmonary = primary bronchus

# Bronchi

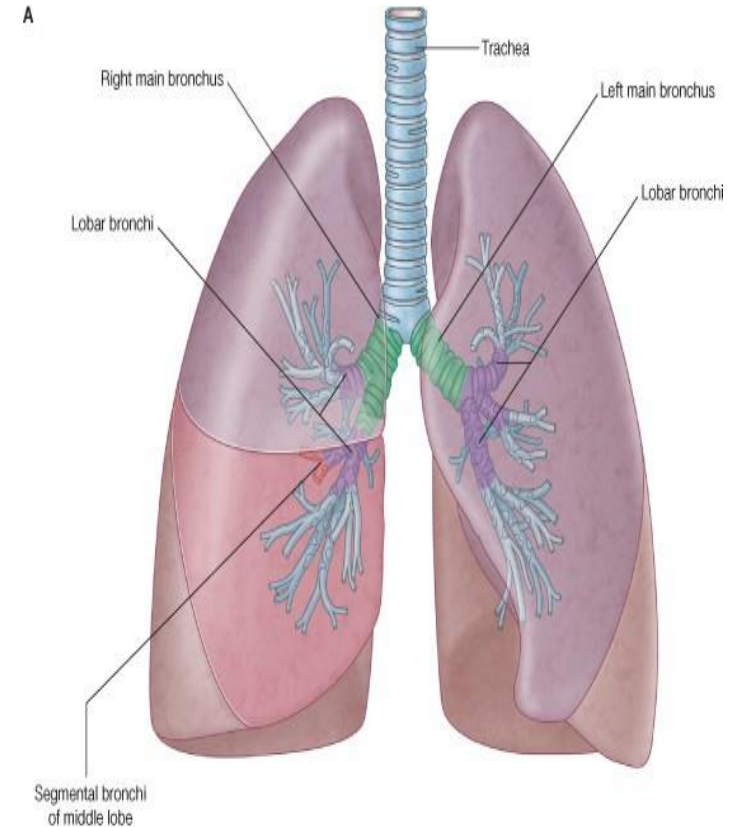
- Each main bronchus enters the root of a lung and passes through the hilum into the lung itself.
- The **right main bronchus** is wider and takes a more vertical course and is about 1 in. (2.5 cm)
- principal bronchus gives off the superior lobar bronchus. On entering the hilum, it divides into a middle and an inferior lobar bronchus.
- the **left main bronchus is narrower, longer, and more horizontal than the right and is about 2 in. (5 cm) long**
- passes to the left below the arch of the aorta and in front of the esophagus
- the principal bronchus divides into a superior and an inferior lobar bronchus.
- *Therefore, inhaled foreign bodies tend to lodge more frequently on the right side than on the left.*

- **Kindly check this slide, doctor didn't mention all info here, but they are important for coming lectures**



# Bronchial tree

- The main bronchus divides within the lung into **lobar bronchi** (secondary bronchi),
- each of which supplies a lobe.
- On the right side, the lobar bronchus to the superior lobe originates within the root of the lung.
- The lobar bronchi further divide into **segmental bronchi** (tertiary bronchi), which supply **bronchopulmonary segments**



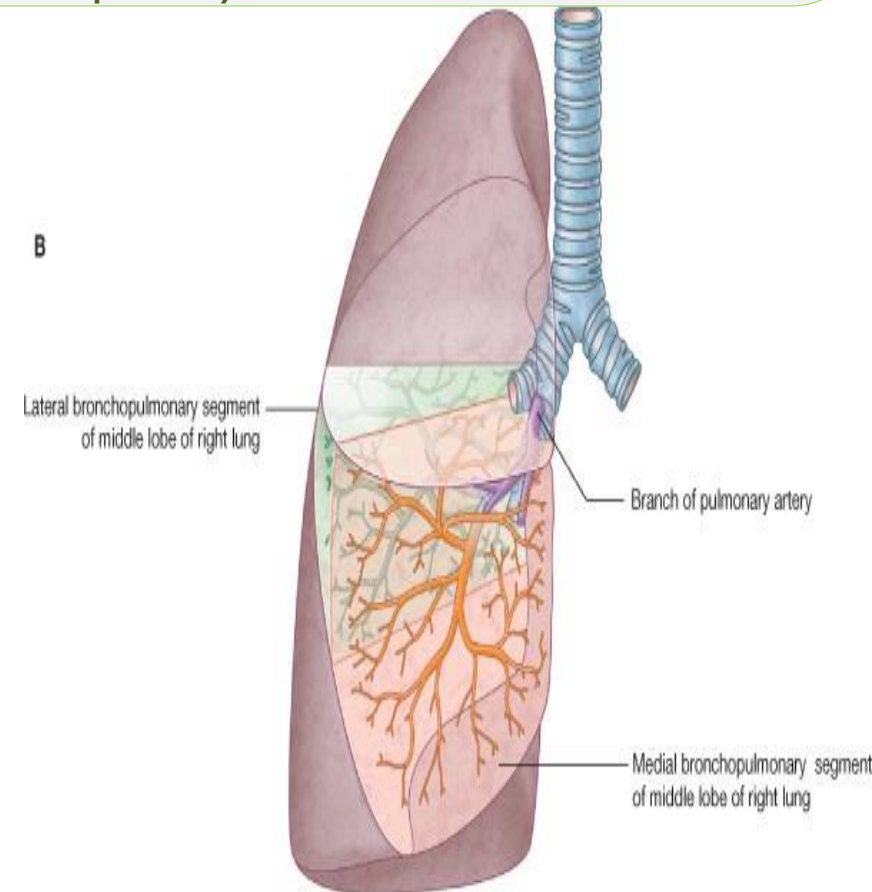


- On the **right lung**, the main bronchus divides into the hilum of the lung into two branches (totally three lobar bronchi, since the right lung has three lobes and two fissures):
  1. **Eparterial bronchus**: Supplies the upper (superior) lobe. It is called "eparterial" because it arises above the pulmonary artery.
  2. **Hyparterial bronchi**: (divided into two) These are the middle and lower lobe bronchi, arising below the pulmonary artery, supplying the middle and lower lobes respectively.
- On the **left lung**, the main bronchus divides after the hilum of the lung (inside the lungs) into two lobar branches, since the left lung has two lobes and one fissure.
- The primary (main) bronchus has hyaline cartilage as **plates**.
- The secondary (lobar) bronchus is intra pulmonary and has hyaline cartilage as **plates**.
- The tertiary (bronchopulmonary segment) bronchus the number of cartilage plate is between 1 to 2

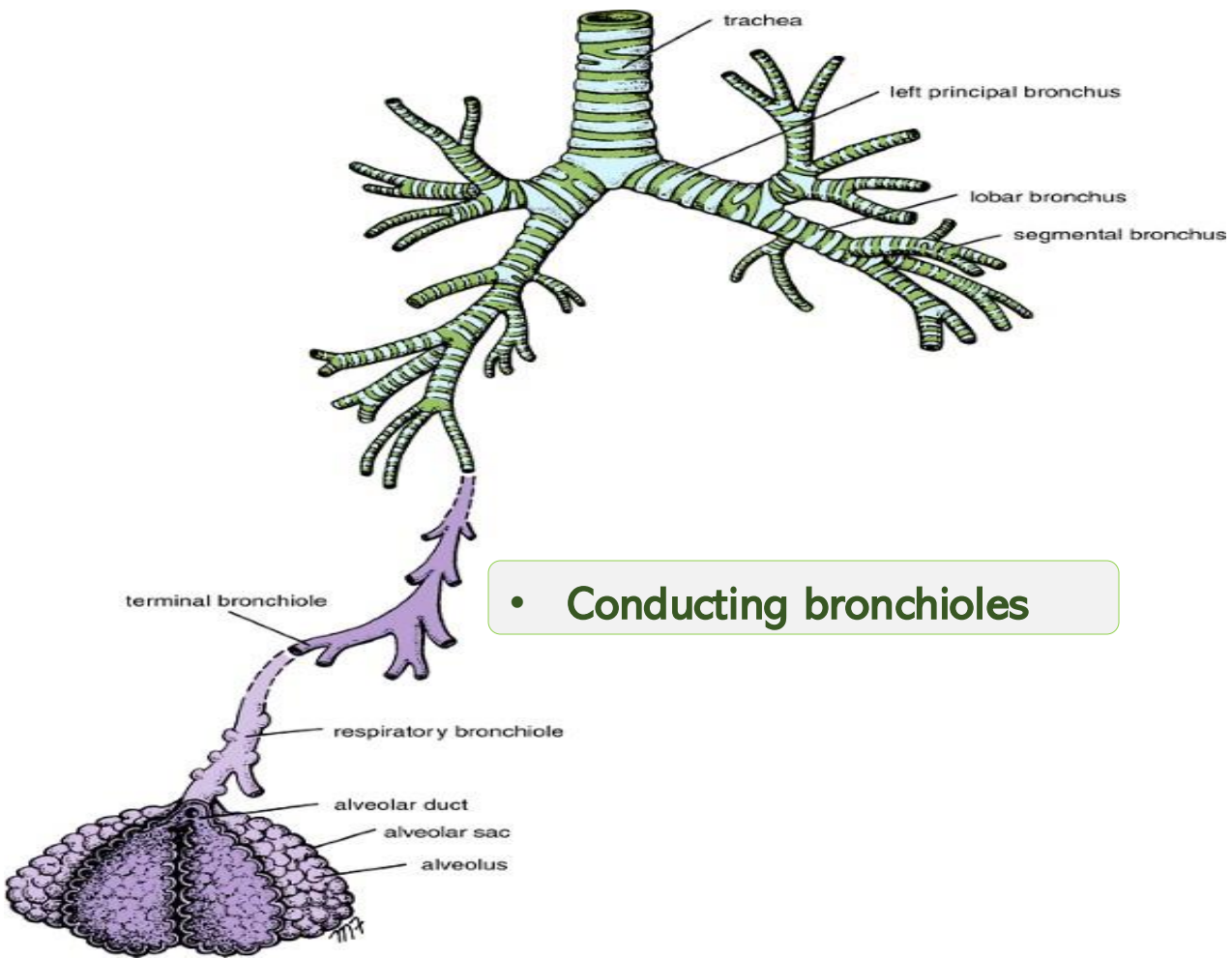
# Bronchial tree

- In the terminal bronchiole there is no cartilage, no goblet cells, no glands
- There is **excess of spiral smooth muscle** (surround all the lumen)
- In the respiratory bronchiole there is a gradual change from the simple ciliated columnar or cuboidal to simple non-ciliated (Clara cells), then to simple squamous epithelium in the respiratory bronchiole until the end of the alveoli (for gas exchange ability)
- Also, in the respiratory bronchiole the smooth muscle decrease sharply, and change to **knops of smooth muscles** (small pieces)

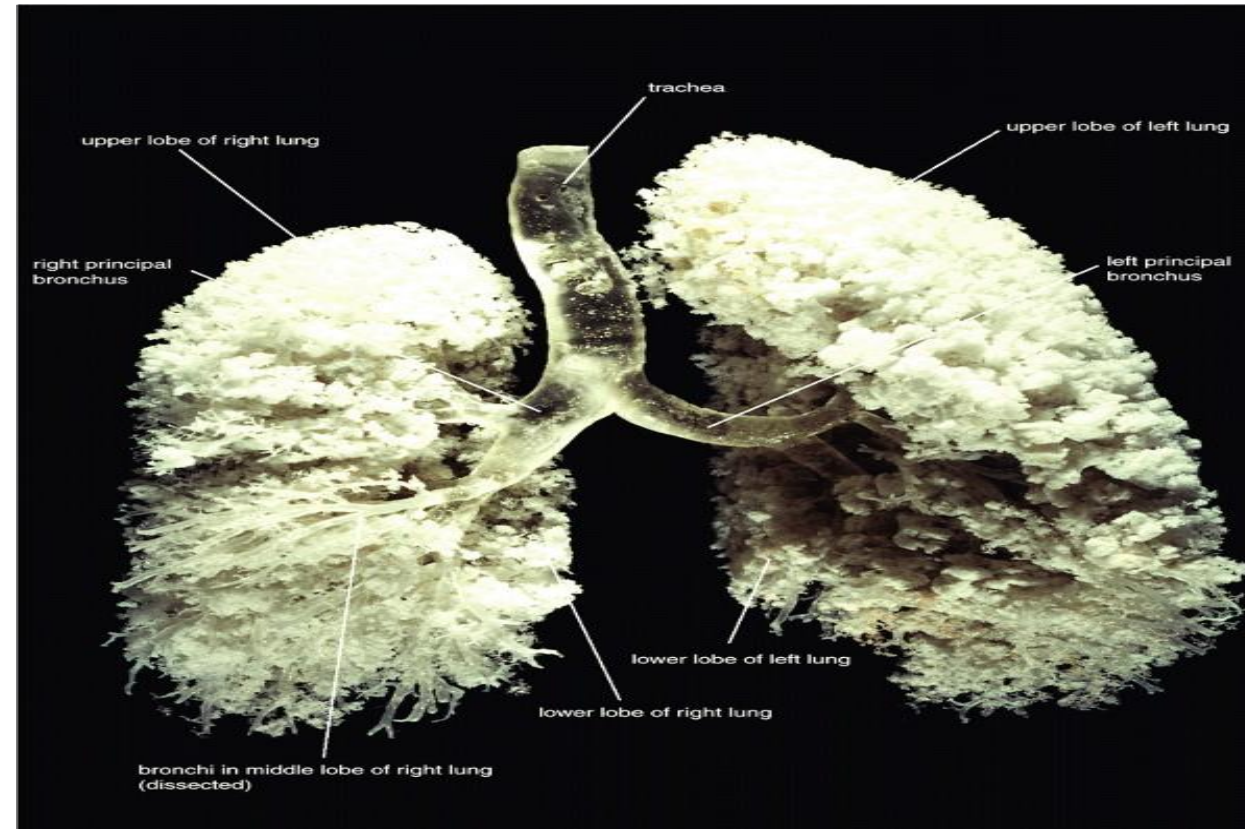
- **bronchopulmonary segment** further divide into terminal bronchioles & these into respiratory bronchioles which end in the pulmonary unit .
- Pulmonary unit consist of alveolar ducts, atria air sacs pulmonary alveoli.
- The walls of the bronchi are held open by discontinuous elongated plates of cartilage, but these are not present in bronchioles.



# Bronchial tree

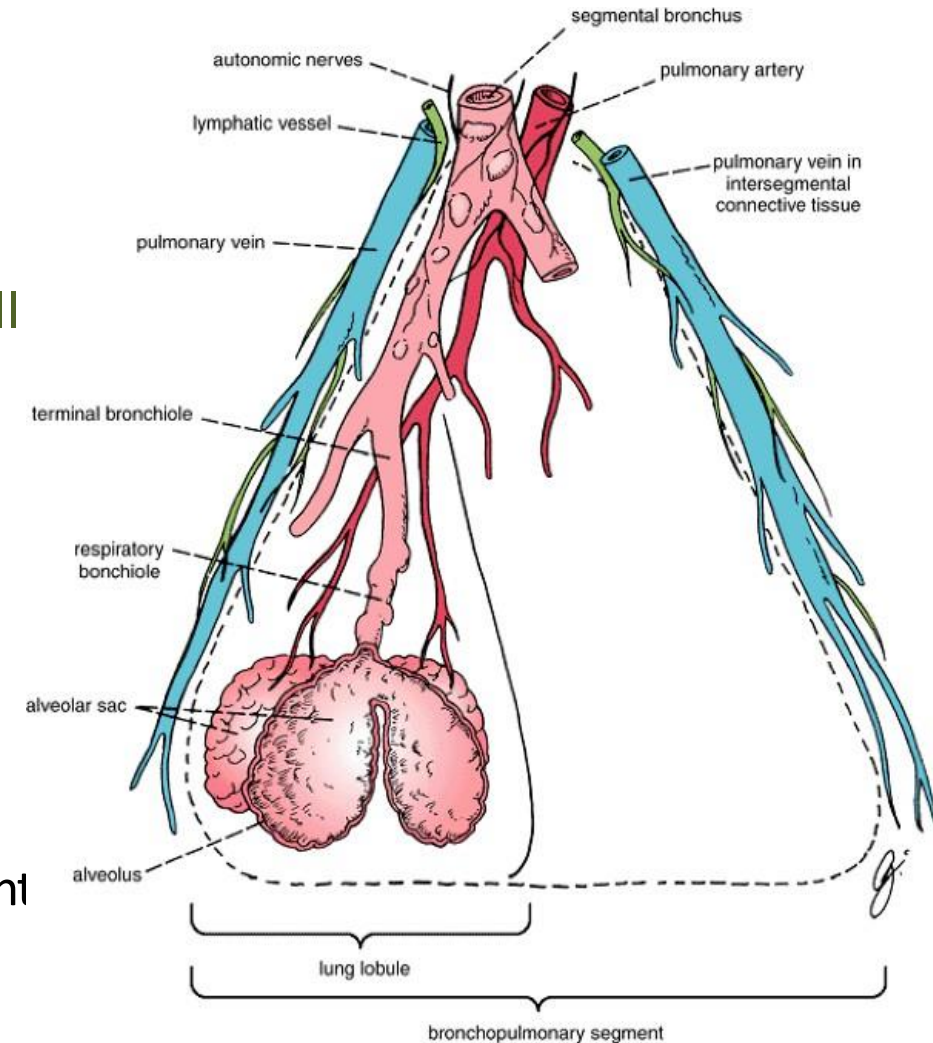


• Conducting bronchioles



# Bronchopulmonary segments

- A **bronchopulmonary segment** is the area of lung supplied by a segmental bronchus and its accompanying pulmonary artery branch
- It is a subdivision of a lung lobe.
- It is pyramid shaped, with its apex toward the lung root. The base will be toward the lung surface
- It is surrounded by connective tissue.
- It has a segmental bronchus, bronchiole, respiratory bronchiole, alveolar sac and alveoli, a segmental artery, lymph vessels, and autonomic nerves.
- The **two** segmental vein lies in the connective tissue between adjacent bronchopulmonary segments. (on the lateral sides)
- **Because it is a structural unit, a diseased segment can be removed surgically.** Surgeons find the segments through the two segmental veins





# Bronchopulmonary segments

## Rt. Lung 10 segments

### Upper lobe

- 1) Apical (toward the apex)
- 2) posterior (toward the posterior border of the upper lobe)
- 3) Ant (toward the anterior border of the upper lobe)

### Middle lobe

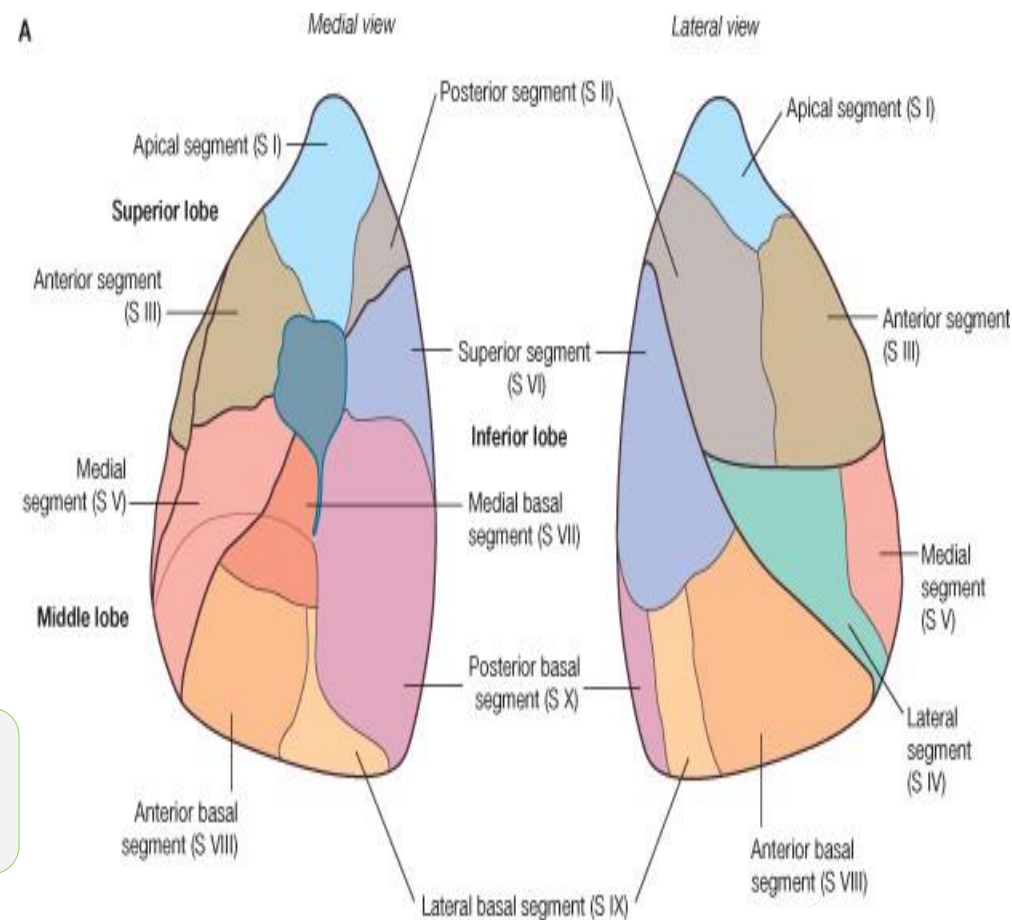
- 1) Medial (toward the mediastinum surface)
- 2) Lateral (lateral compared to the medial, see the picture)

### Basal lobe

- 1) Apical (apico basal) (the most superior in the basal lobe)
- 2) Anterior
- 3) Medial
- 4) Lateral
- 5) Posterior

- The Bronchopulmonary segments in the basal lobe in the right and left lung is the same

- The tertiary (bronchopulmonary segment) bronchus: 10 in each lung
  - the upper lobe: 3 segments (tertiary bronchi)
  - The middle lobe : 2 segments
  - The basal lobe: 5 segments





- it's important to note that the foreign bodies enter the right main bronchus, then secondary then the segments
- In erect position the foreign body will lodge in the **posterior segment in the basal lobe**
- In spine position the foreign body will lodge in the **apical segment of the basal lobe (apicobasal)**

# Bronchopulmonary segments

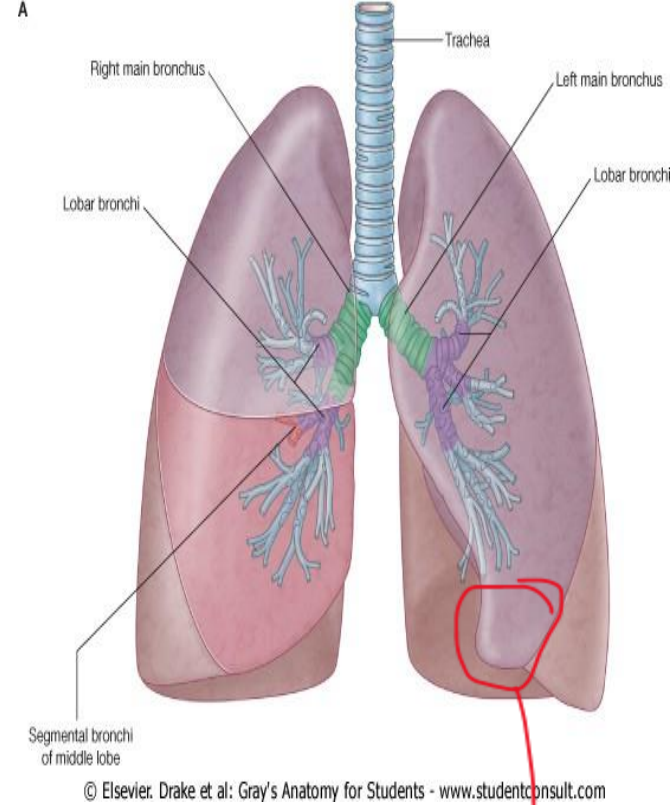
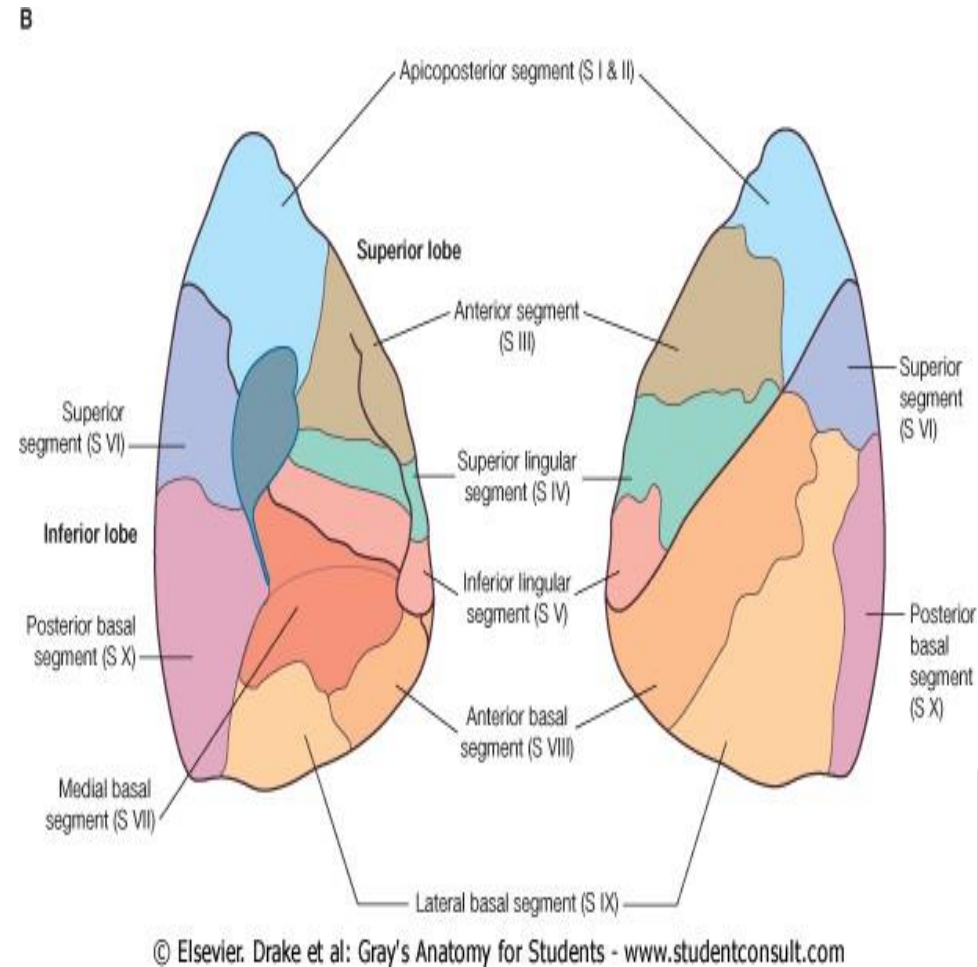
## Lt. lung 10 segments

### Upper lobe

- 1) Apical
- 2) Posterior
- 3) Ant
- 4) sup. Lingual
- 5) inf. lingual

### Basal lobe

- 1) Apical( apico basal)
- 2) Ant
- 3) Med
- 4) Lat
- 5) Post



- The lingula of the left lung, we called the bronchi segment that reach this area superior or inferior lingual segment

- When the heart is enlarged it deviate the left lung to the left side causing the formation of the lingula and cardiac notch.



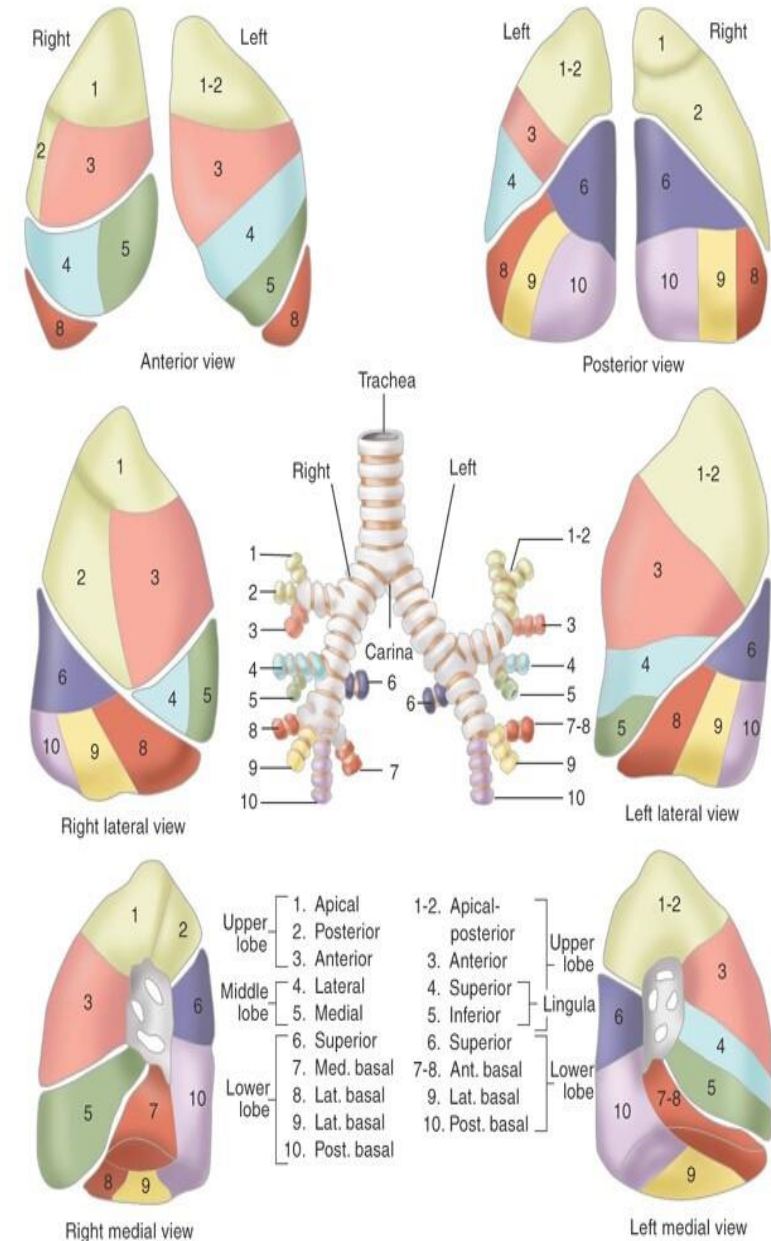
# Bronchopulmonary segments

**Table 7-6** ▶▶ Bronchopulmonary Segments\*

Segment	Number	Segment	Number
<b>Right Upper Lobe</b>		<b>Left Upper Lobe</b>	
Apical	1	Upper division	
Posterior	2	Apical-posterior	1 and 2 <sup>†</sup>
Anterior	3	Anterior	3
<b>Right Middle Lobe</b>		<b>Left Lower Lobe</b>	
Lateral	4	Lower division (lingula)	
Medial	5	Superior lingula	4
<b>Right Lower Lobe</b>			
Superior	6	Inferior lingula	5
Medial basal	7	Superior	6
Anterior basal	8	Anterior basal	7 and 8
Lateral basal	9	Lateral basal	9
Posterior basal	10	Posterior basal	10

\*The subdivisions of the lung and bronchial tree are fairly constant. Slight variations between right and left sides are noted by combined names and numbers.

**NOTE:** Some authors feel that the left lung should be numbered so that there are eight segments, where the apical-posterior is numbered 1 and the anteromedial is numbered 6.



# Bronchopulmonary segments

## Before birth:

- Rt. Lung 10 segments

- Lt. lung 8 segments

- Apico posterior segment: after birth it divide into apical segment and posterior segment

- Antero medial: after birth it divide into anterior segment and medial segment

- The apico posterior segment is in the upper lobe, and the antero medial segment is in the basal lobe.

# Clinical importance of pulmonary segments

- Infections (usually in the segments but there is no barrier to stop the spread of the infection)
- No barrier
- **Surgery** (segment is very important in surgery)
- Postural drainage (will be covered in next lectures)
- **Bronchoscopy:** used to remove foreign bodies, it's important to investigate first the right lung to see in any segment the foreign bodies has reached and use the bronchoscope to remove it.





VERSIONS	SLIDE #	BEFORE CORRECTION	AFTER CORRECTION
V1→ V2	22		Last sentence is corrected to : The apico posterior segment is in the upper lobe, and the antero medial segment is in the basal lobe.
V2→V3			



امسح الرمز و شاركنا بأفكارك لتحسين أدائنا !!