Respiratory system

Trachea & Bronchi

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By the end of this lecture you must know:

- **Trachea (begin, end and important relation).**
- **Blood supply of trachea.**
- **Lymphatic drainage of trachea**
- **Nerve supply of trachea**
- **Comparison between right and left main bronchus.**
- **Segmental divisions of bronchi.**
- **Bronchopulmonary segments.**
- **Histology of trachea.**
- **Histology of bronchial tree.**

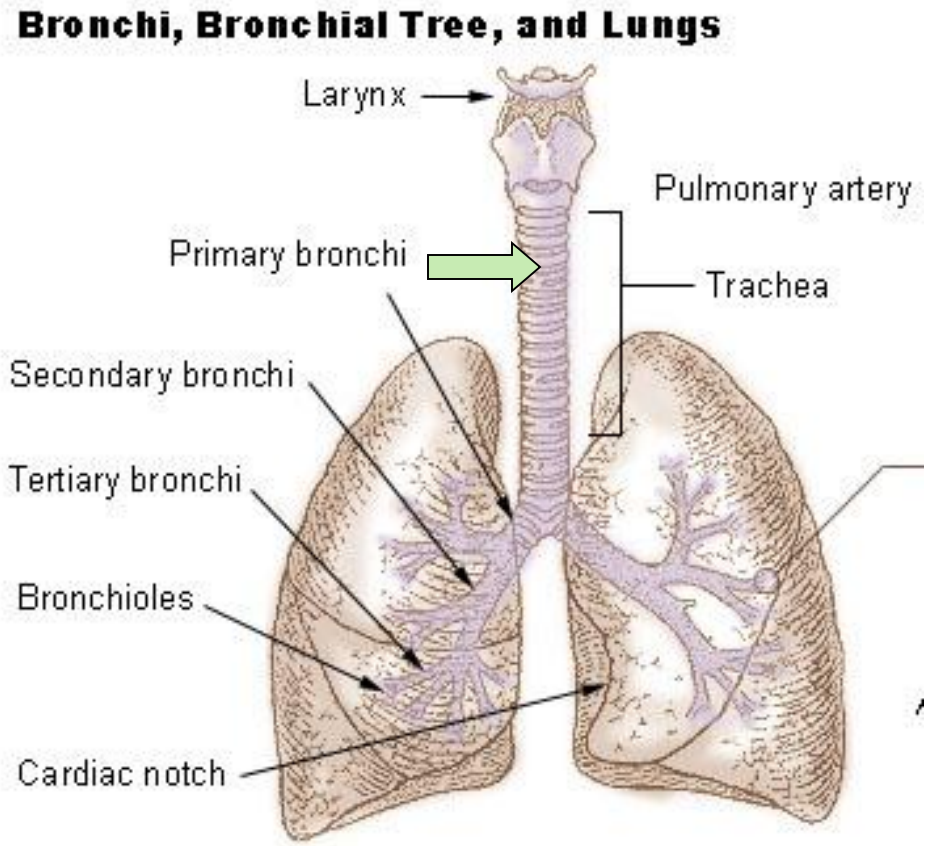
The Trachea

@A fibromuscular tube.

@Has incomplete cartilage rings to keep it always opened.

@Carries air into & out of the lungs.

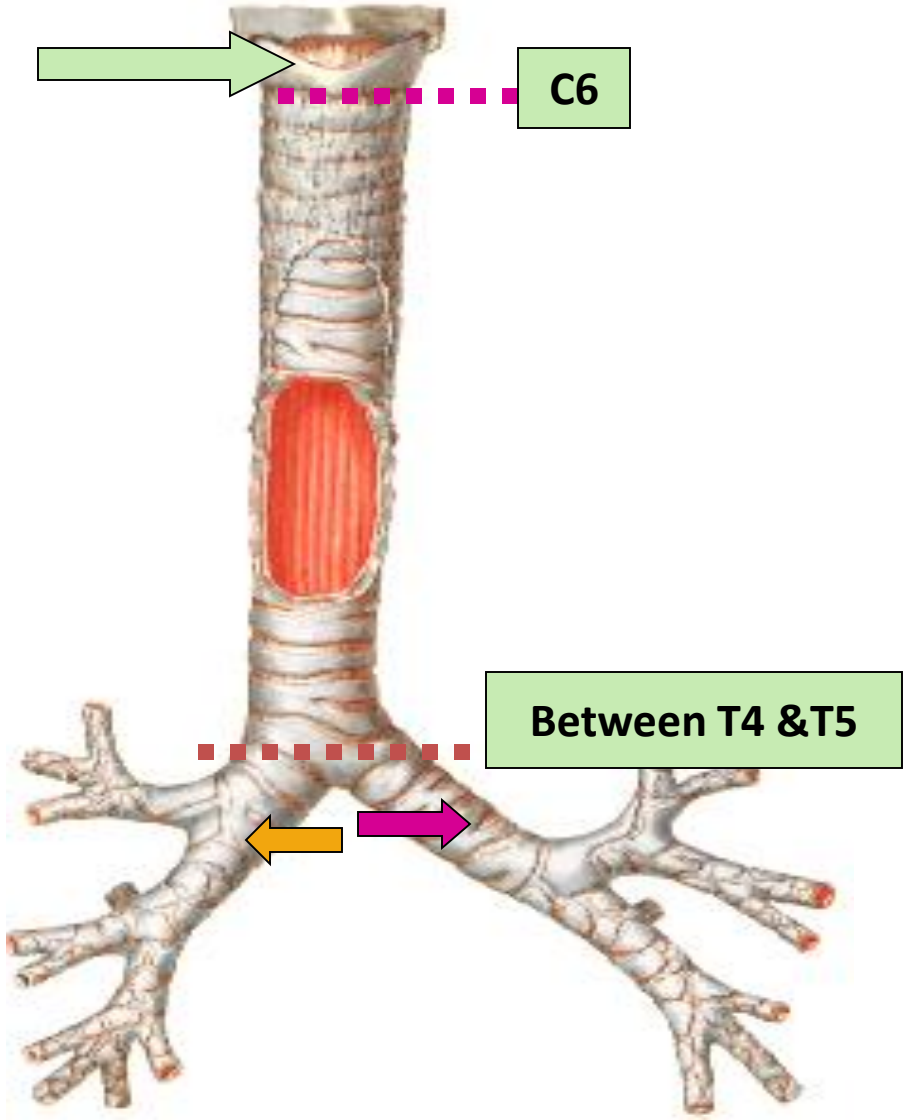
@ It is 10-12cm long



Trachea (cont.)

@Begins : in median plane at lower border of cricoid cartilage of larynx opposite lower border of C6 vertebra.

@Ends : opposite sternal angle between T4 & T5 vertebrae by dividing into right & left main bronchi.



Trachea (cont.)

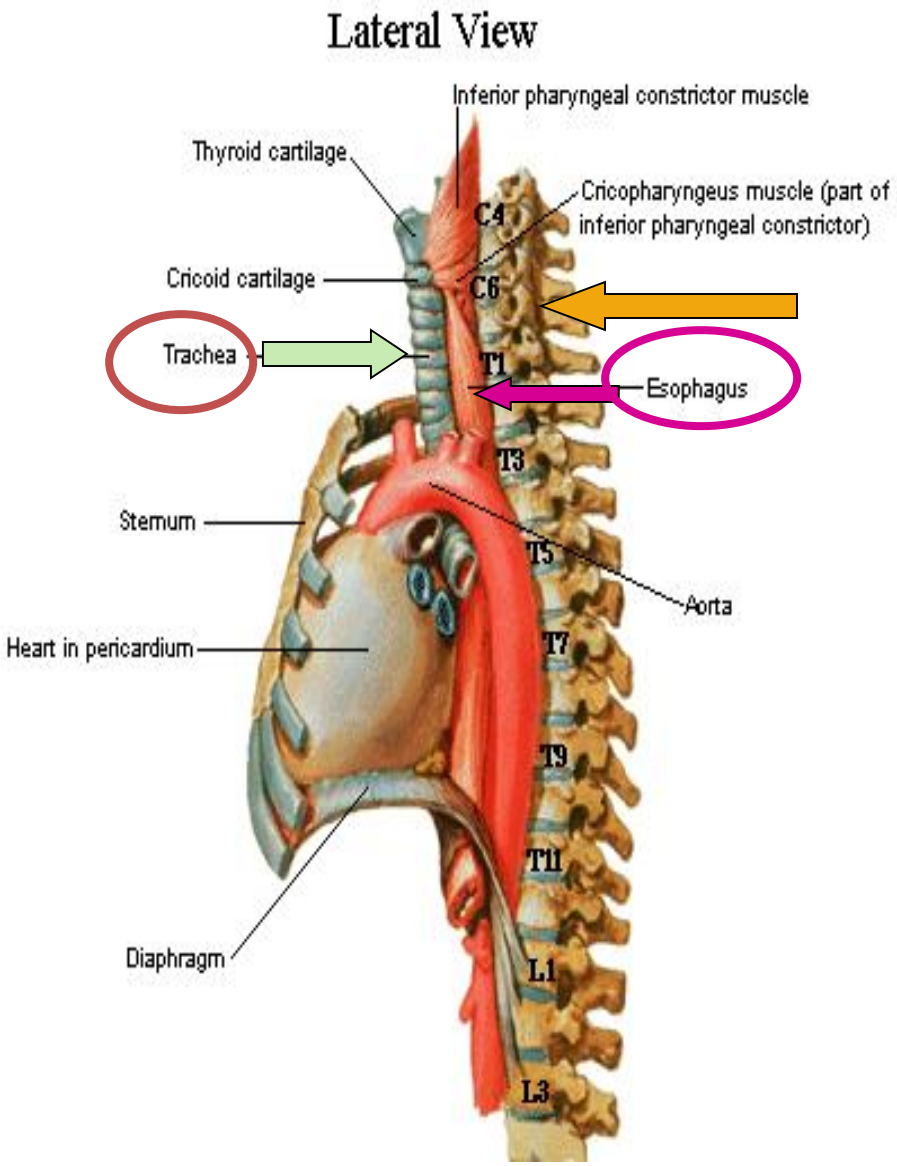
@Upper ½ of trachea lie
in the neck.

@Lower ½ of trachea
lies in the thorax.

@Relations :

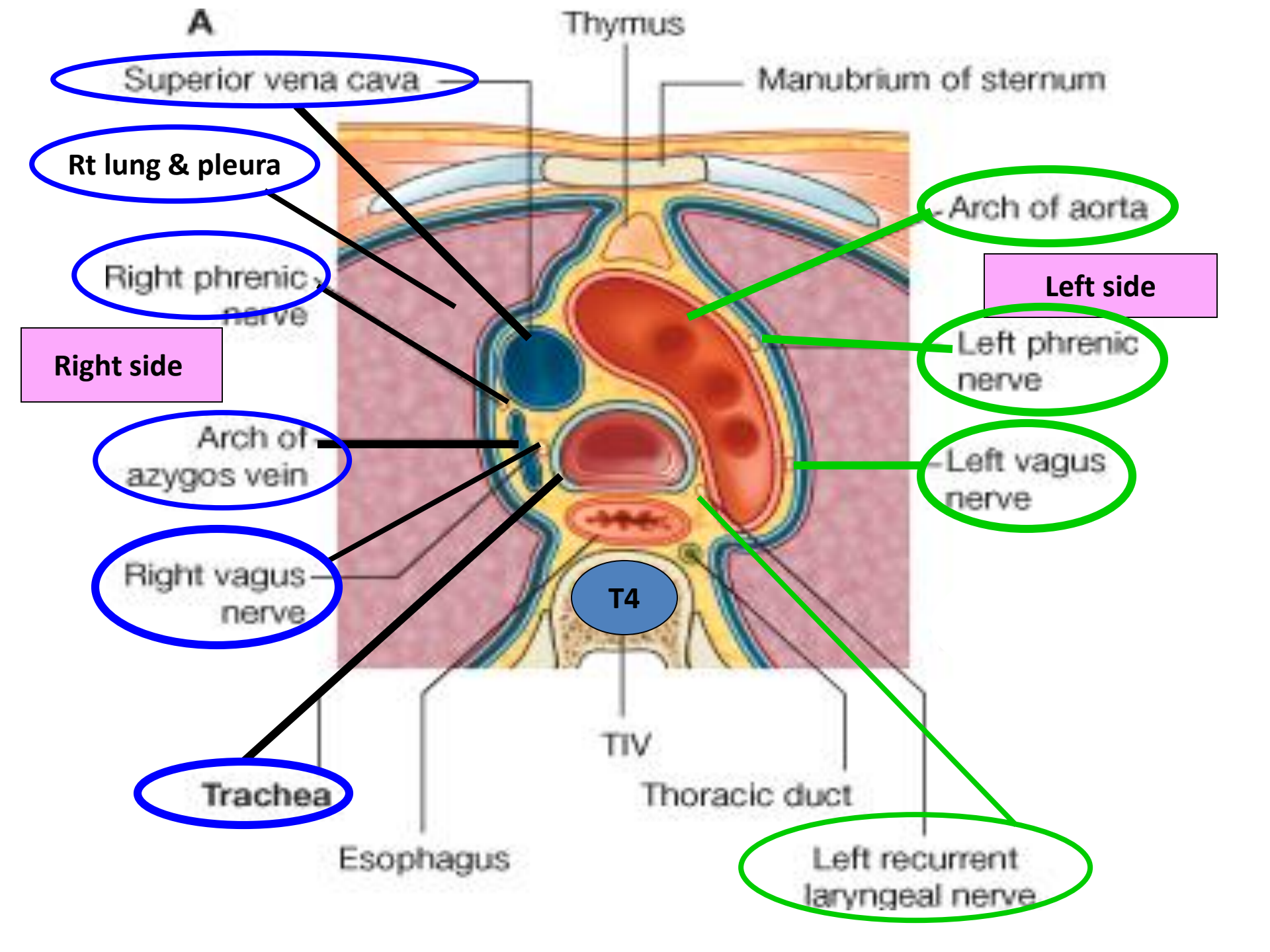
@Posteriorly :

*Oesophagus which
lies immediately
anterior to the
vertebral column.



Relations of trachea

On its right side	On its left side
1. Right vagus nerve.	1.Left vagus nerve.
2. Arch of azygos vein.	2. Arch of aorta (& its 3 big branches).
3. Right phrenic nerve.	3. Left phrenic nerve.
4. SVC.	4. Left recurrent laryngeal nerve (in groove between trachea & oesophagus).
5. Right lung & pleura.	5. Left lung & Pleura.


A
Thymus
Superior vena cava
Manubrium of sternum
Rt lung & pleura
Arch of aorta
Right phrenic nerve
Left side
Right side
Left phrenic nerve
Arch of azygos vein
Left vagus nerve
Right vagus nerve
T4
TIV
Trachea
Thoracic duct
Esophagus
Left recurrent laryngeal nerve

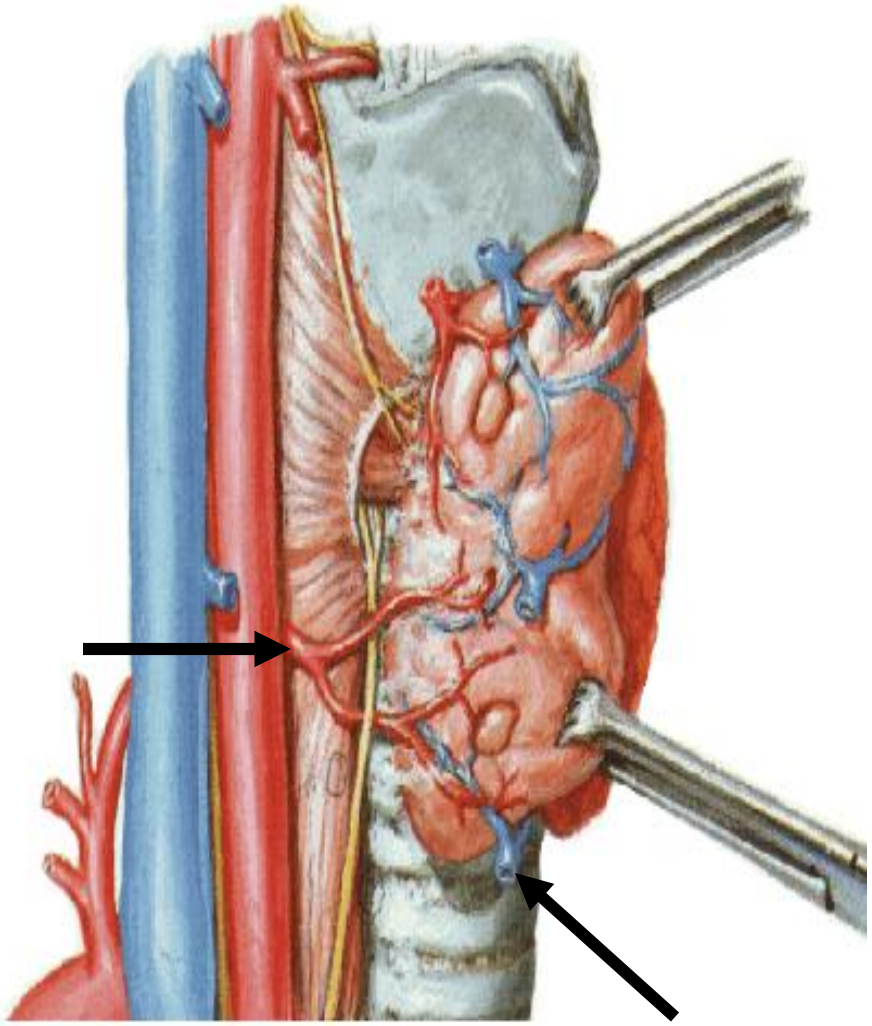
Blood supply of trachea

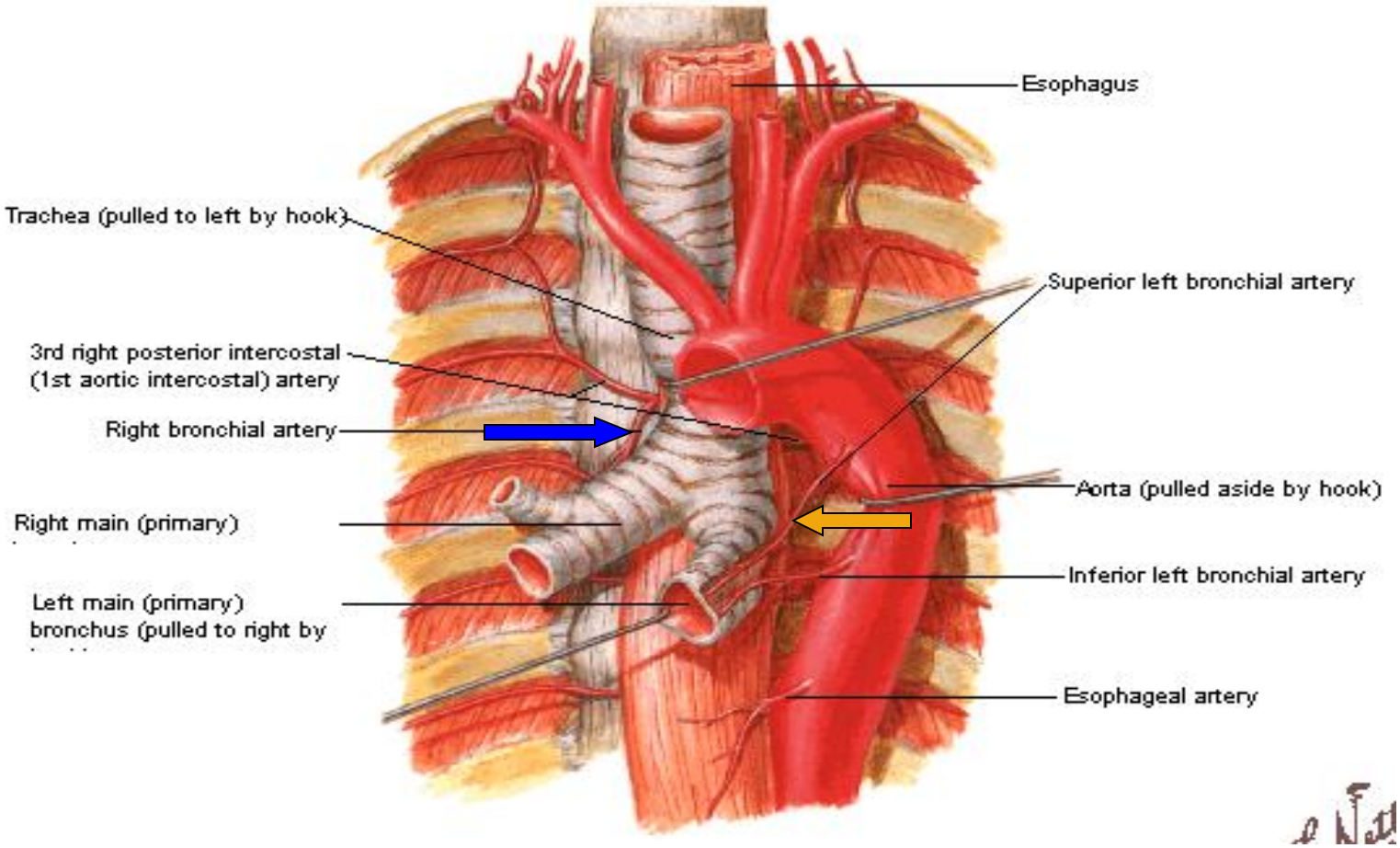
@Arterial supply:

- **Mainly from inferior thyroid artery**
- **Region of bifurcation → bronchial arteries.**

@Venous drainage :

- **Into inferior thyroid veins to left brachiopcephlic vein**



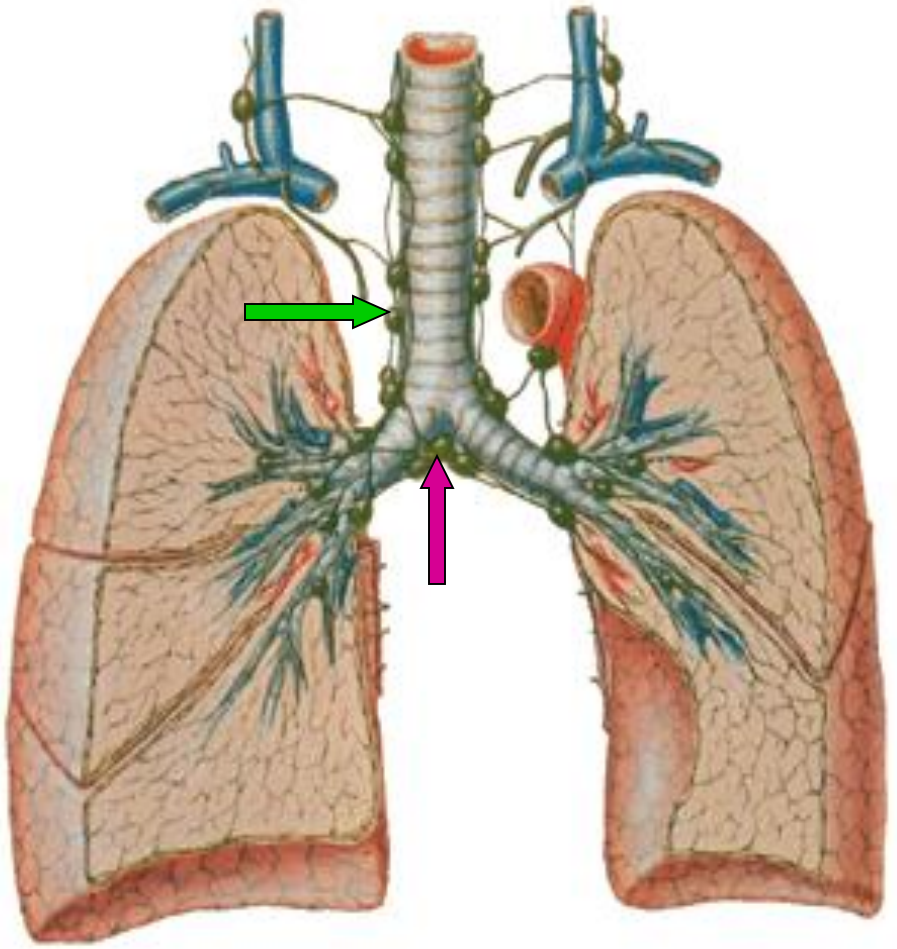


Region of bifurcation of trachea is supplied by Bronchial vessels

Lymphatic drainage of the trachea

@Pretracheal & paratracheal LNs.

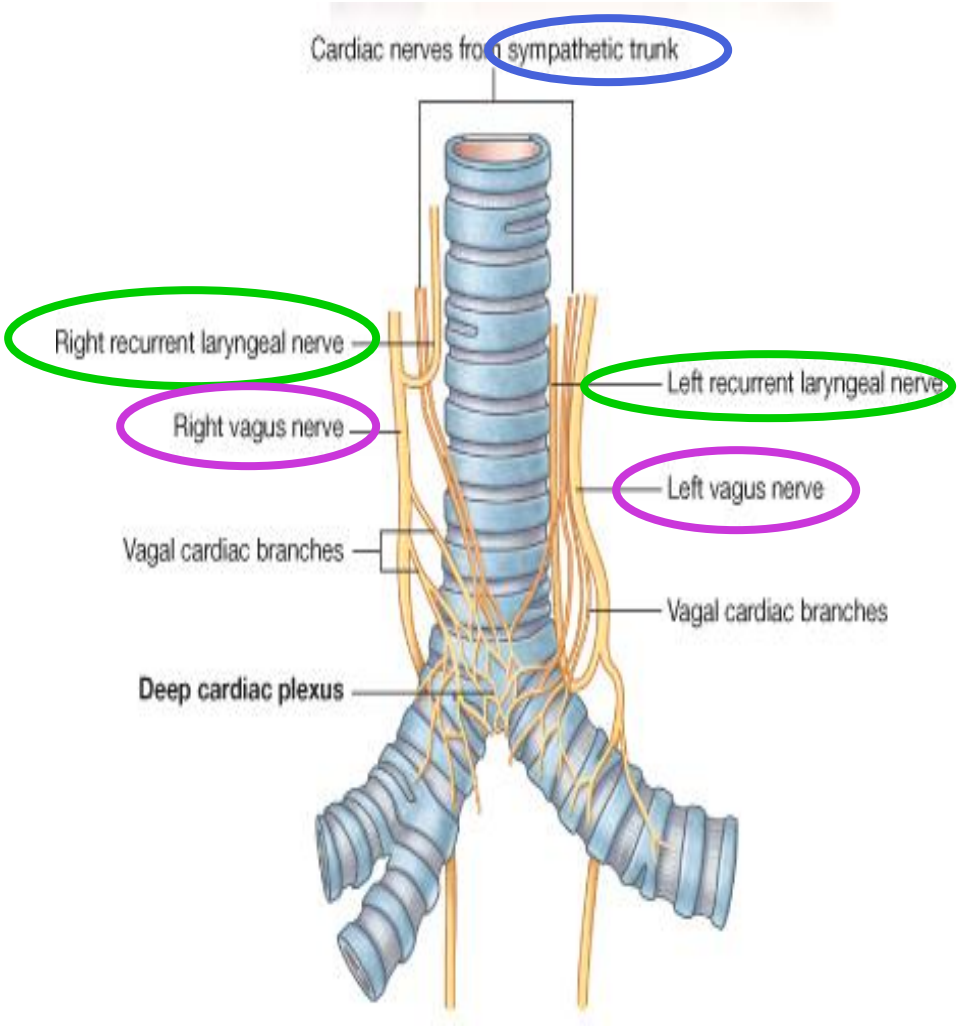
@Region of bifurcation → tracheobronchial LNs.



Nerve supply of trachea

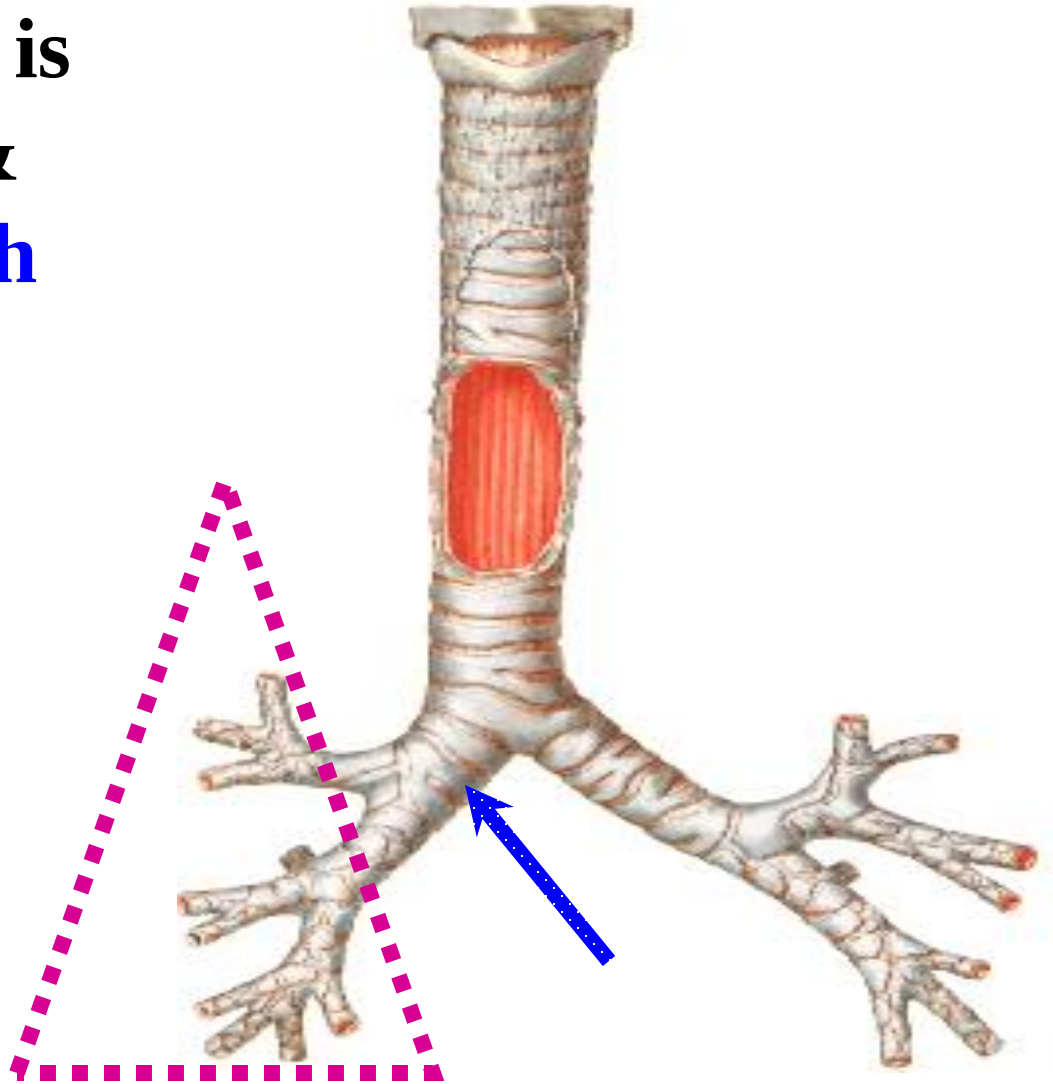
@<u>Sympathetic</u> from thoracic sympathetic trunks.

- **<u>Parasympathetic</u> from both Vagi & recurrent laryngeal nerves.**



The main bronchi

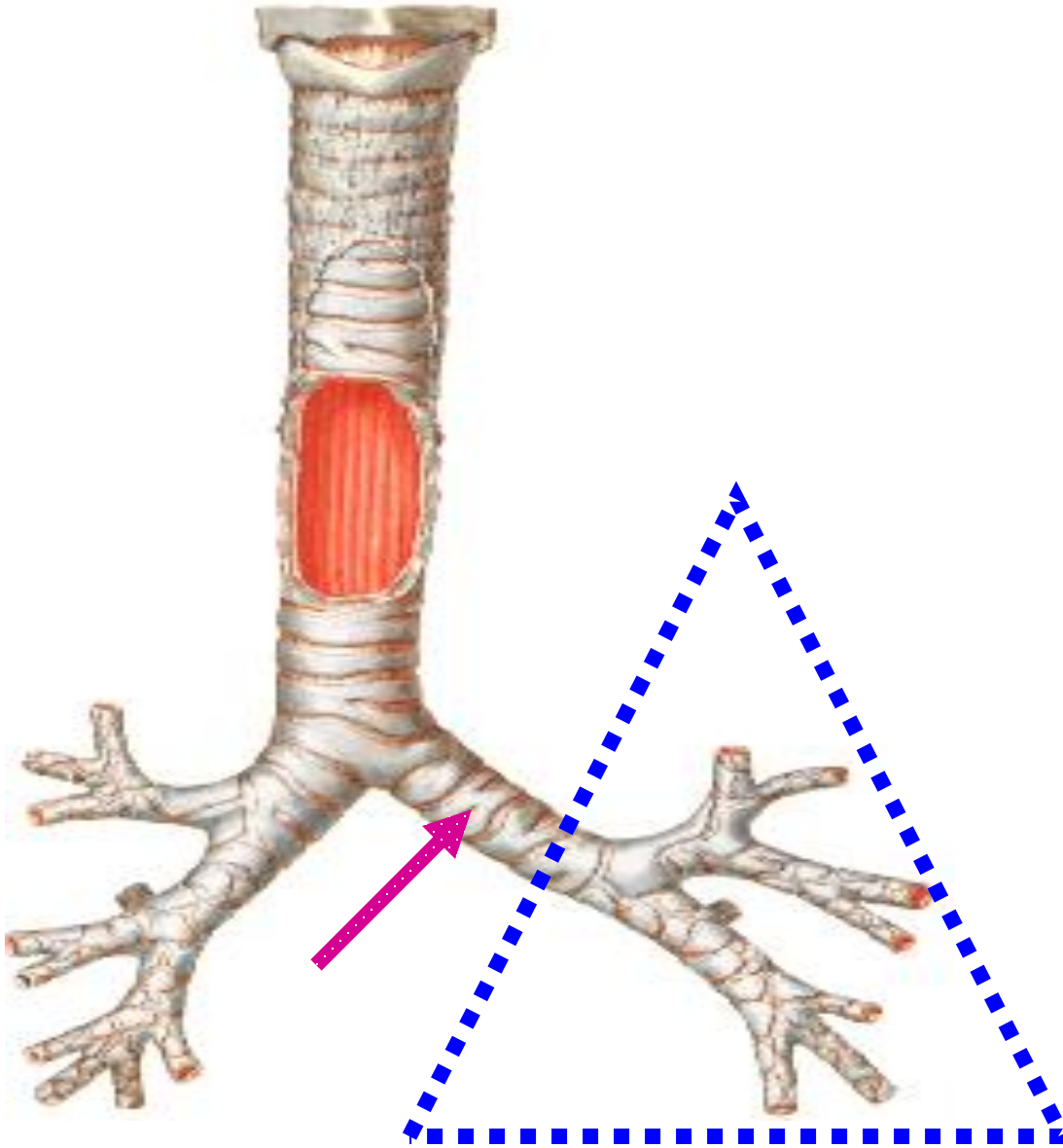
@Right bronchus is shorter, wider & more in line with the trachea. It usually divides before entering the right lung.



Left bronchus

@Longer, narrower & more oblique.

@Divides after entering into the hilum of left lung.



Applied Anatomy

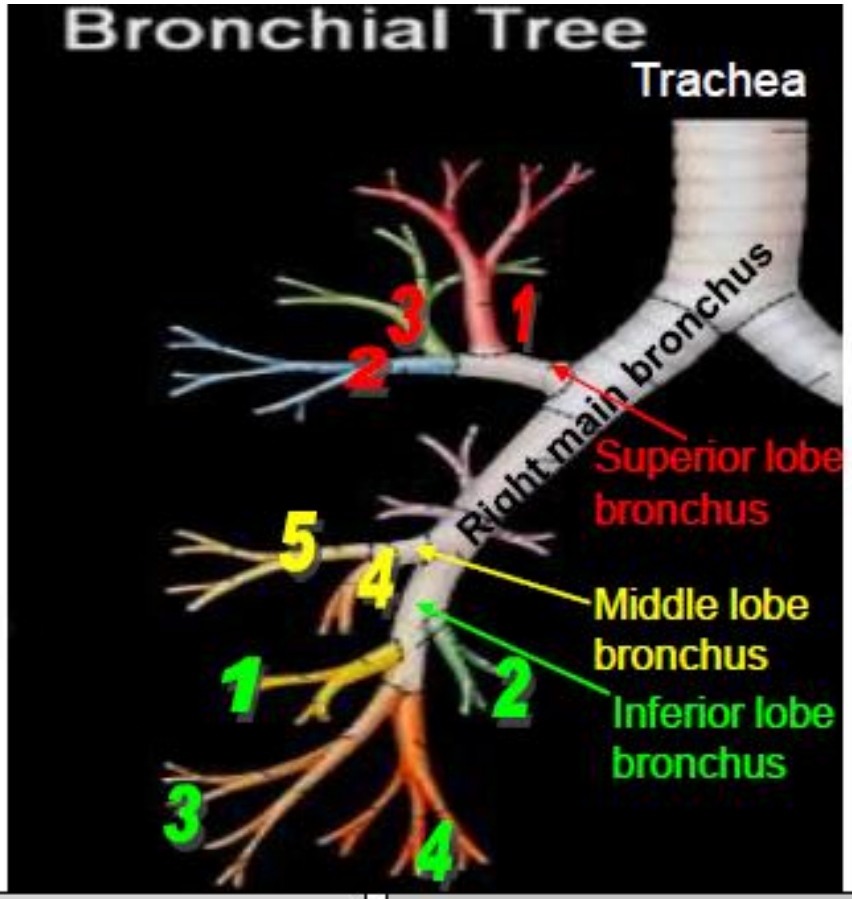
- **Why do foreign bodies entering into the trachea reach the right bronchus rather than the left bronchus ?**

Differences between right and left bronchi

	Right bronchus	Left bronchus
Length	Short (2.5 cm)	Long (5 cm)
Diameter	Wide	Narrow
Course	Vertical, in line with trachea	Oblique or horizontal
Division into lobar bronchi	Extrapulmonary	Intrapulmonary

So, any Foreign body entering the trachea will lodged into the right lower lobar bronchus.

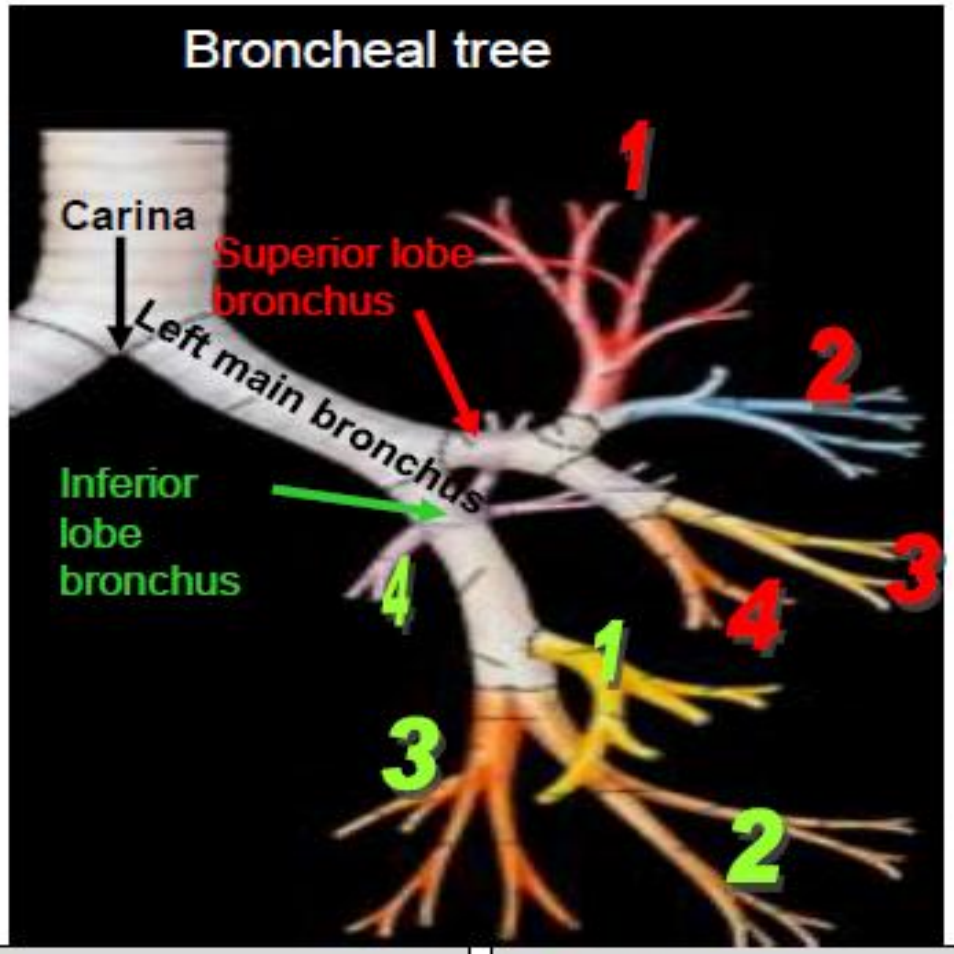
Segmental branches of right bronchus



1- Apical	Superior lobe	
2- Anterior		
3- Posterior		
4- Medial	Middle lobe	
5- Lateral		

1- Superior	Inferior lobe	
2- Medial basal		
3- Lateral basal		
4- Posterior basal		

Segmental branches of left bronchus



1- Apicoposterior	Superior lobe	1- Superior	Inferior lobe
2- Anterior		2- Anteromedial basal	
3- Superior lingular		3- Lateral basal	
4- Inferior lingular		4- Posterior basal	

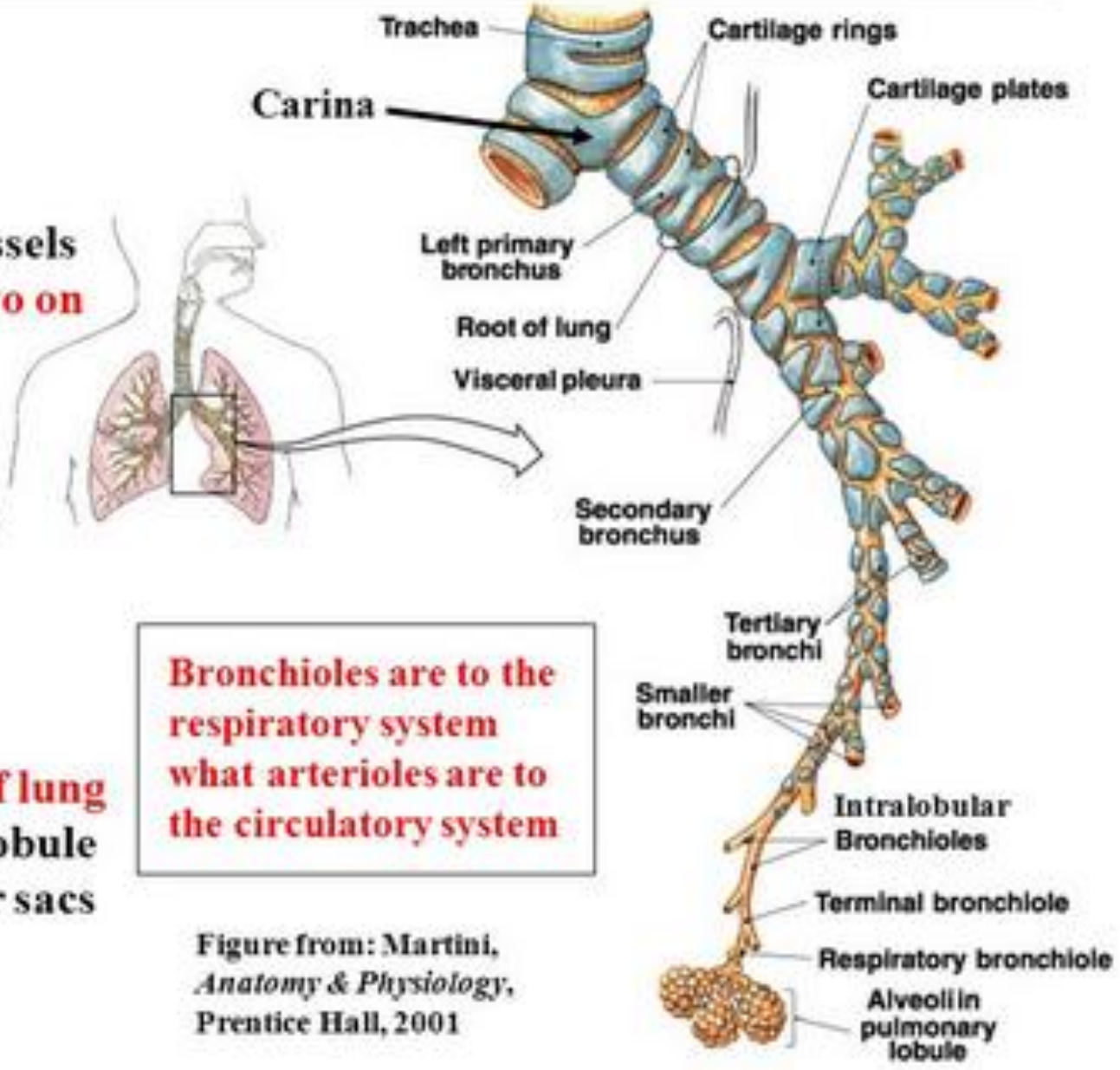
Bronchial Tree

Bronchi

- **Primary**; w/ blood vessels
- **Secondary (lobar)**; **two on left, three on right**
- **Tertiary (segmental)**; supplies a broncho-pulmonary segment; 10 on right, 8 on left

Bronchioles

- Intralobular; supply **lobules, the basic unit of lung**
- **Terminal**; 50-80 per lobule
- **Respiratory**; a few air sacs budding from theses

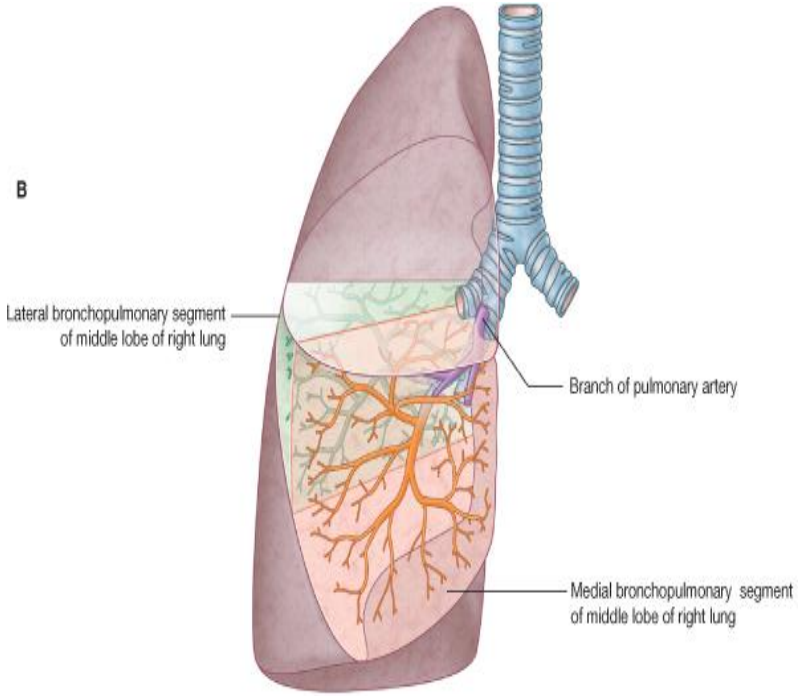


Bronchioles are to the respiratory system what arterioles are to the circulatory system

Figure from: Martini, *Anatomy & Physiology*, Prentice Hall, 2001

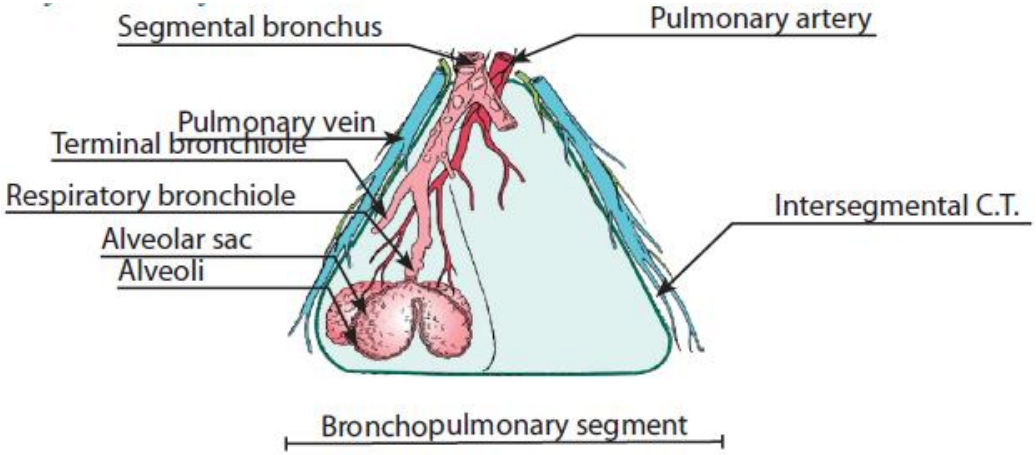
Bronchopulmonary Segments of Lungs

@ **Each lung is subdivided into functional (for exchange of gases) segments; each of which receives its own branch from bronchus, pulmonary artery & pulmonary vein.**



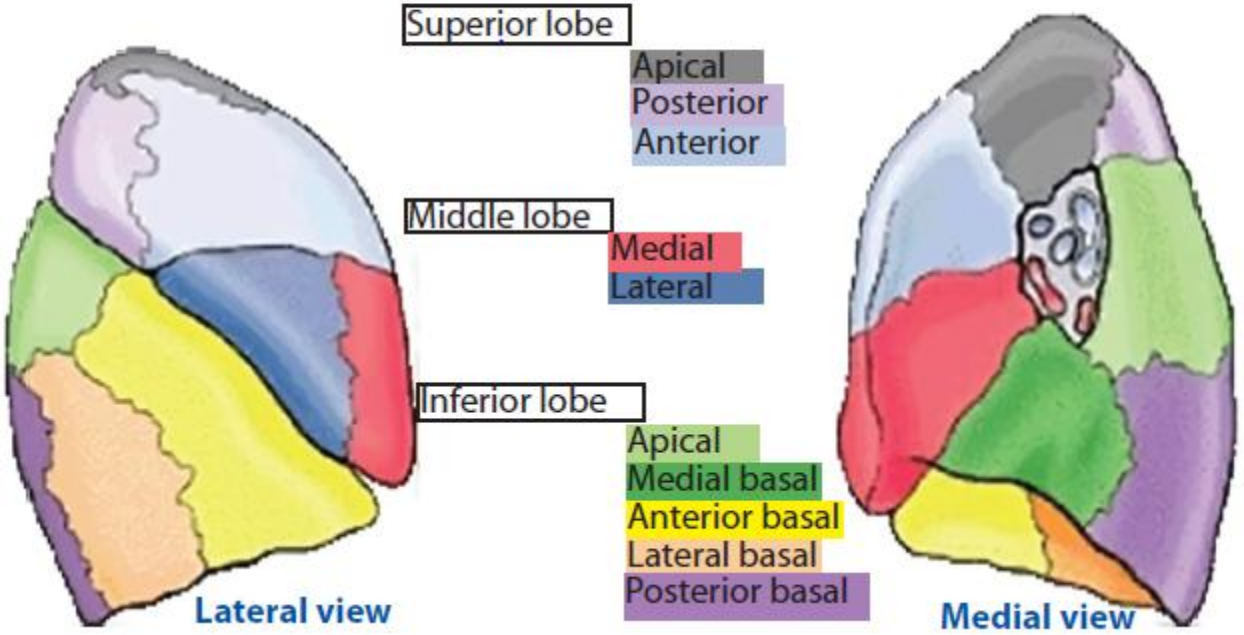
@ **Segments are separated from each other by fibrous septa.**

@Note: **Because it is a structural unit, a diseased segment can be removed surgically.**



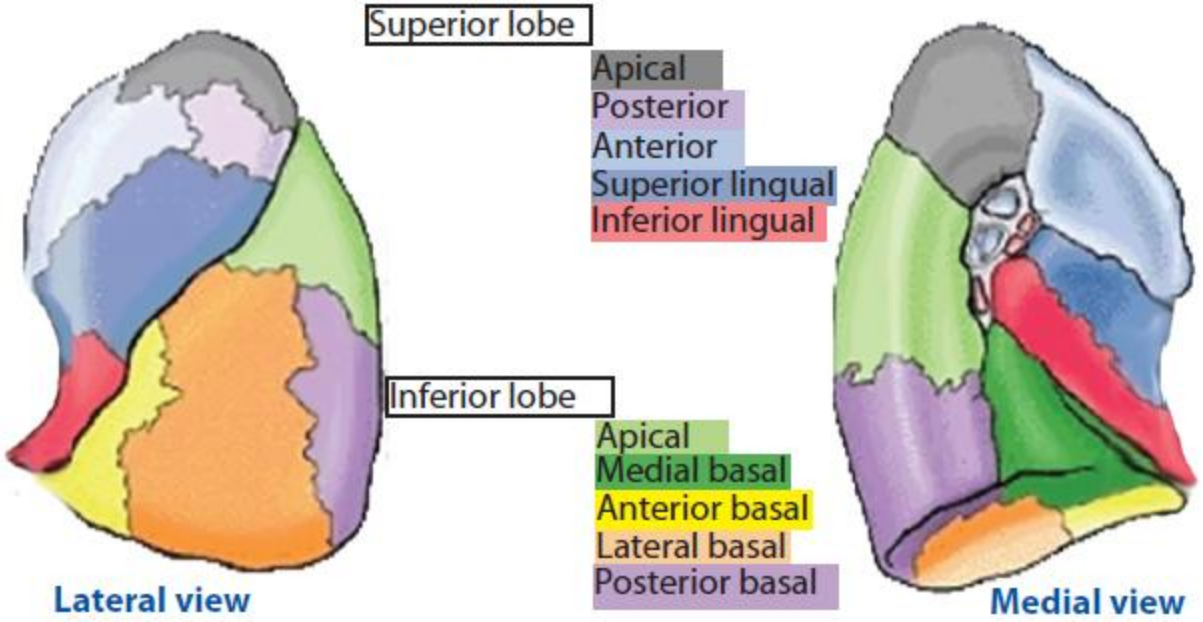
Bronchopulmonary segments of right lung

- **Right lung**
  - **Superior lobe**: Apical, posterior, anterior
  - **Middle lobe:** Lateral, medial
  - **Inferior lobe**: Superior (apical), medial basal, anterior basal, lateral basal, posterior basal



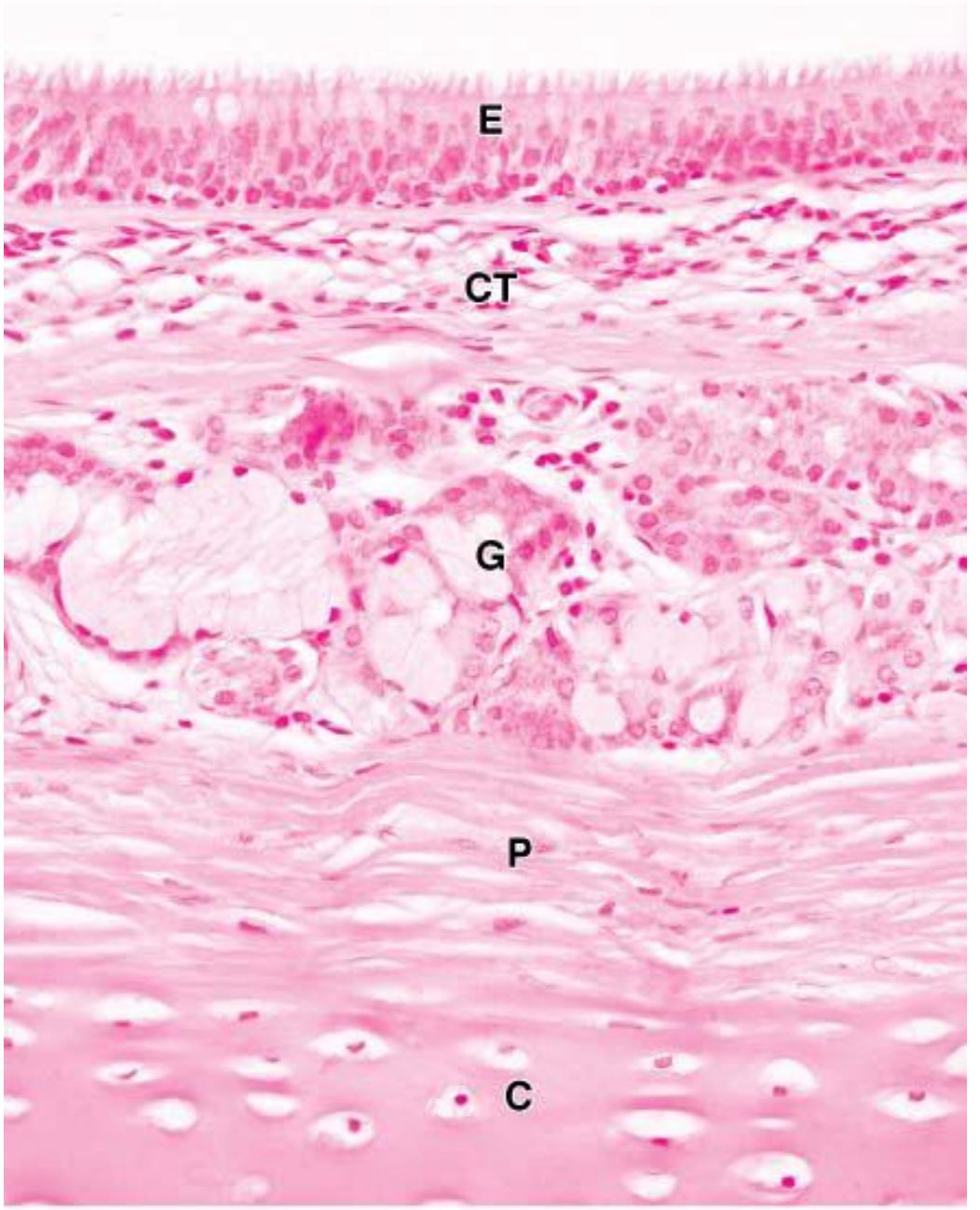
Bronchopulmonary segments of of left lung

- **Left lung**
  - **Superior lobe**: Apical, posterior, anterior, superior lingular, inferior lingular
  - **Inferior lobe**: Superior (apical), medial basal, anterior basal, lateral basal, posterior basal



Histology of trachea

The wall of the trachea is lined by typical respiratory epithelium (E) underlying connective tissue (CT) and seromucous glands (G) in the lamina propria. The submucosa contains C-shaped rings of hyaline cartilage (C) covered by perichondrium (P).



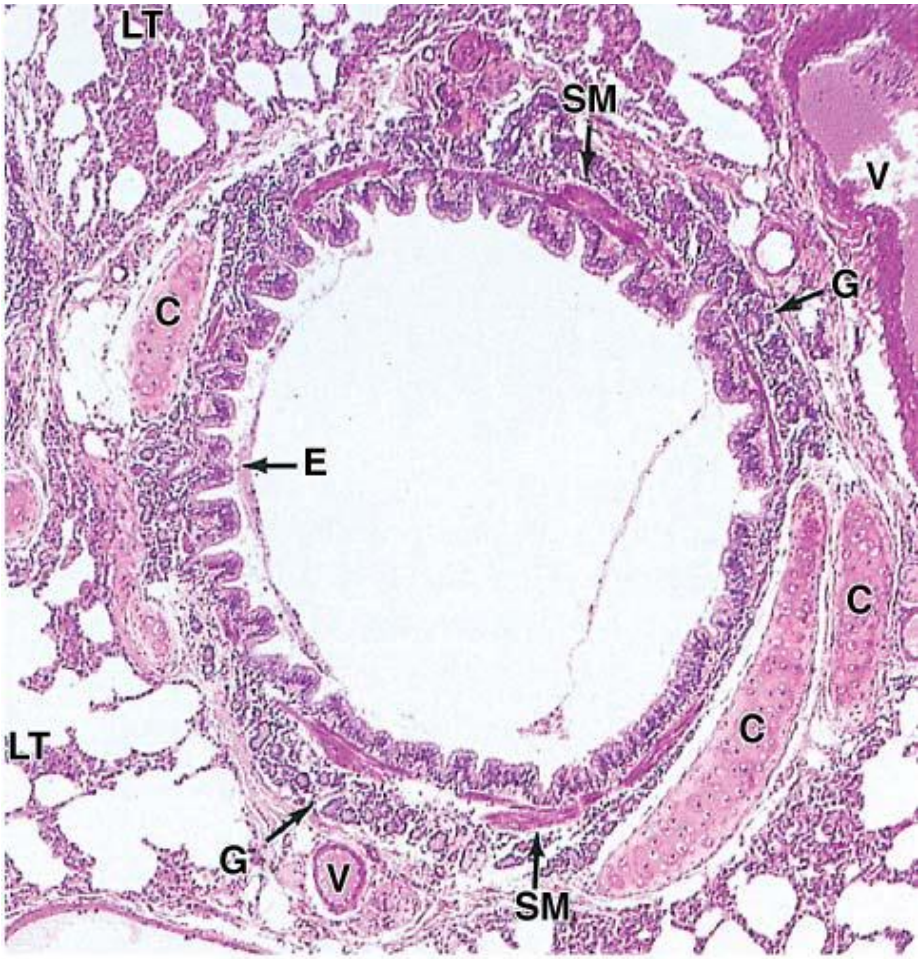
Source: Mescher AL: *Junqueira's Basic Histology: Text and Atlas, 12th Edition:* http://www.accessmedicine.com

Histology of bronchial tree

Bronchi (primary, secondary, tertiary)

- **Each primary bronchus branches repeatedly, with each branch becoming progressively smaller until it reaches a diameter of about 5 mm. The mucosa of the larger bronchi is structurally similar to the tracheal mucosa except for the organization of cartilage and smooth muscle.**

In the primary bronchi most cartilage rings completely encircle the lumen, but as the bronchial diameter decreases, cartilage rings are gradually replaced with isolated plates of hyaline cartilage. Abundant mucous and serous glands are also present, with ducts opening into the bronchial lumen. In the bronchial lamina propria is a layer of crisscrossing bundles of spirally arranged smooth muscle which become more prominent in the smaller bronchial branches.



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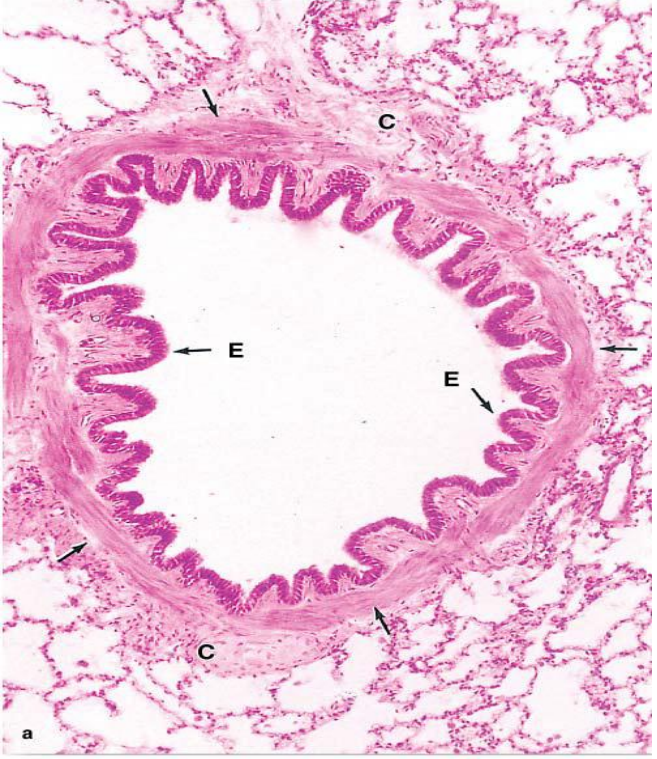
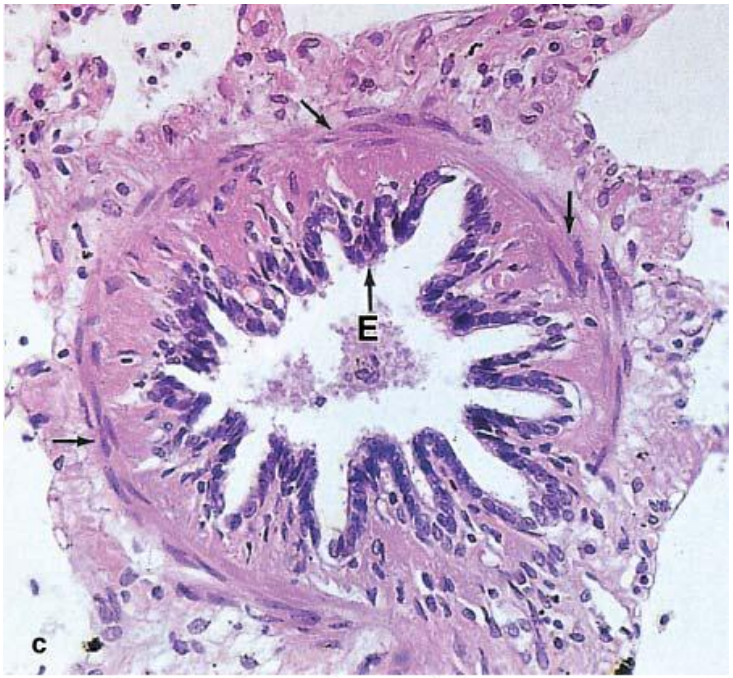
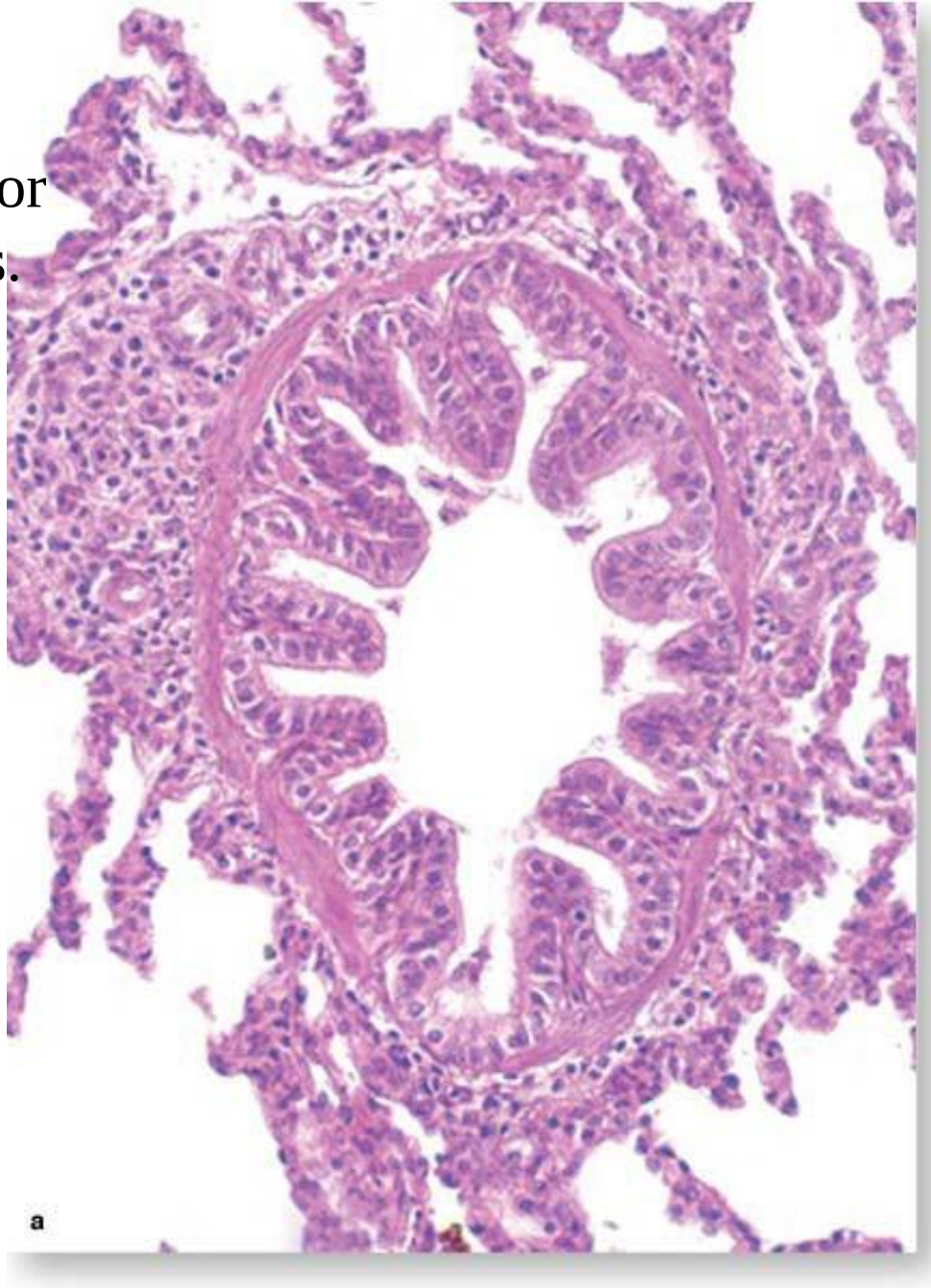


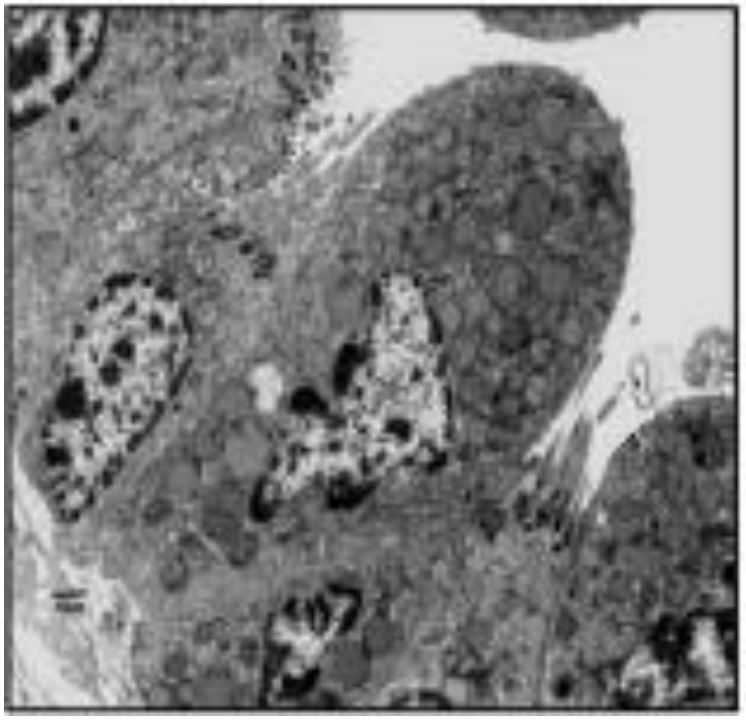


(a): A large bronchiole has the characteristically folded respiratory epithelium (E) and prominent smooth muscle (arrows), but is supported only by fibrous connective tissue (C) with no glands. **((c):** In very small bronchioles the epithelium (E) is reduced to simple low columnar and the several layers of smooth muscle cells (arrows) comprise a high proportion of the wall.

terminal bronchiole has only one or two layers of smooth muscle cells. The epithelium contains ciliated cuboidal cells and many low columnar nonciliated cells (clara cells).

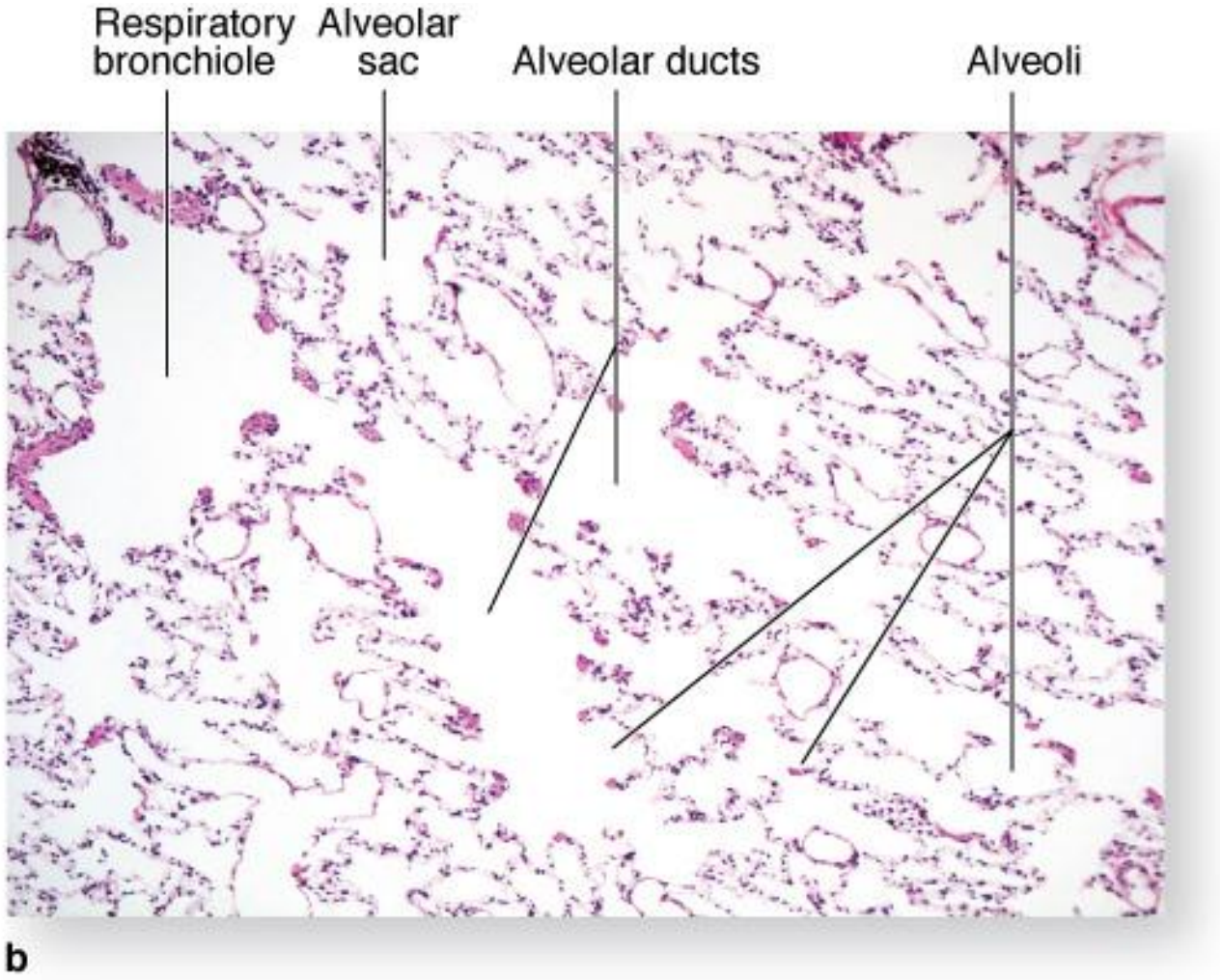


- **Clara cell Site:** **Present in** terminal **bronchioles. It is scattered between ciliated cells. - L/M: it is a tall, non ciliated dome-shaped cell. - E/M: numerous mitochondria, rER, well developed Golgi and apical electron dense secretory granules. It shows short blunt microvilli**
- **Function: Secrete serous secretion rich in protein which has anti-inflammatory function.**



Respiratory Bronchioles

- Each terminal bronchiole subdivides into two or more respiratory bronchioles that serve as regions of transition between the conducting and respiratory portions of the respiratory system.
- The respiratory bronchiolar mucosa is structurally identical to that of the terminal bronchioles, except that their walls are interrupted by the openings to sac like alveoli where gas exchange occurs. Portions of the respiratory bronchioles are lined with ciliated cuboidal epithelial cells and Clara cells, but at the rim of the alveolar openings the bronchiolar epithelium becomes continuous with the squamous alveolar lining cells (type I alveolar cells; see below). Proceeding distally along these bronchioles, the alveoli increase in number, and the distance between them is reduced. Between alveoli the bronchiolar epithelium consists of ciliated cuboidal epithelium, although cilia may be absent in more distal portions. Smooth muscle and elastic connective tissue lie beneath the epithelium of respiratory bronchioles.



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