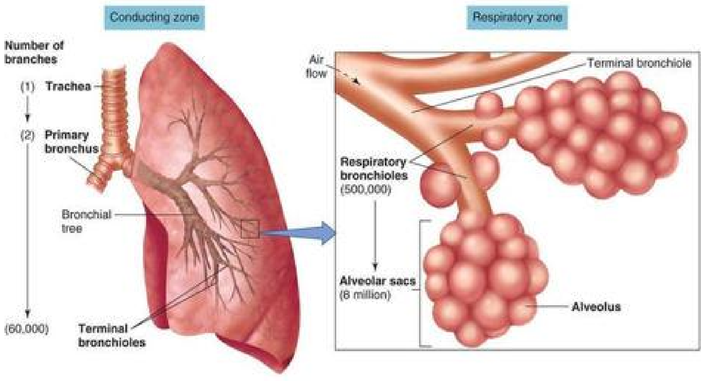
Learning Objectives

- Introduction
- Gross features
- Bronchial Tree
- Microscopic features of different part
- Functional correlations
- Clinical correlates

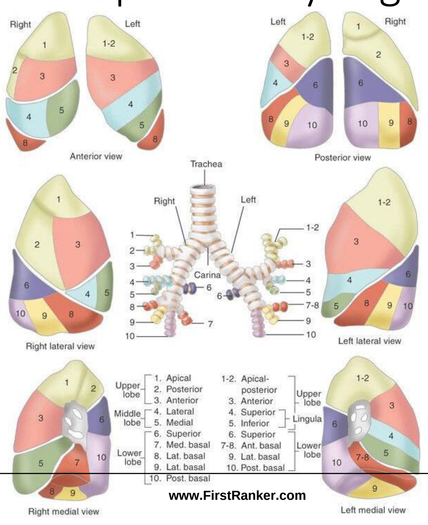
Introduction

- Provide molecular oxygen for cellular oxidation
- Remove carbon dioxide generated
- Vascular or circulatory transport AND Air/Gas transport

Gross Anatomy



Bronchopulmonary Segments



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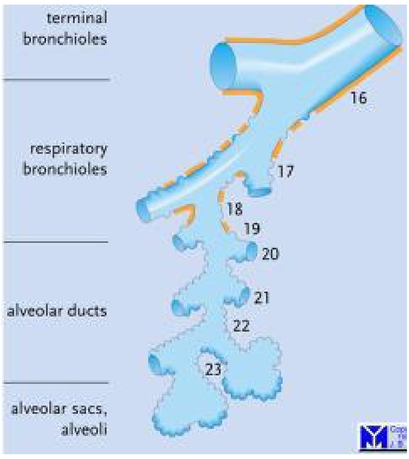

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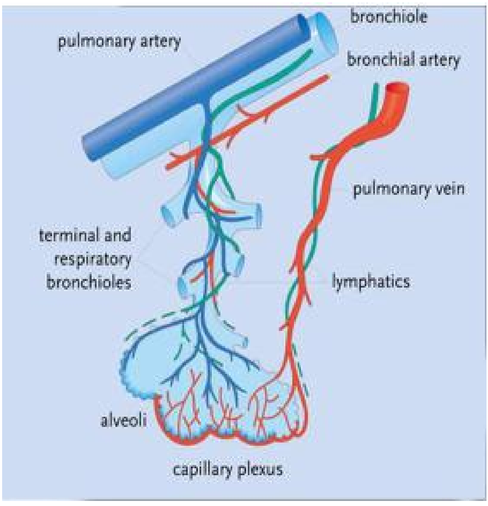

Functional Requirements

- The Respiratory System has tubular components for air/gas conduction
- Plus respiratory components for gas exchange.
- Inspiratory pressure tends to collapse the conducting tubes. They must be held open.
- Other essential functions include: warming; moistening; cleansing by removal of particulate matter; detoxification by absorption of harmful gases; and entrapment of harmful bacteria and viruses.

Conduction

- The nasal cavity is held open by bone and cartilage.
- Most of the additional functions are carried out by pseudostratified columnar ciliated epithelial cells and goblet cells (mucous secretors).
- The cilia beat rhythmically in one direction only
- Move debris and pathogen-laden mucous to the oropharynx and mouth where it is expectorated or swallowed.

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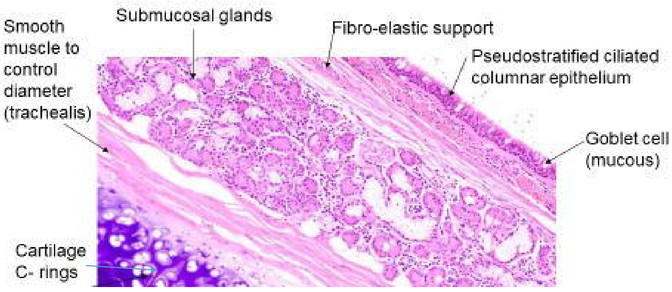
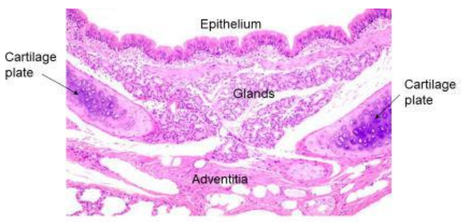
- Air temperature control is by the profuse capillary beds that are beneath the epithelium
- Which warm or cool inspired air.
- Extensive venous plexus, largely replace capillaries in the nasal cavities to modify air temperature

Trachea



Bronchus and Bronchial Tree

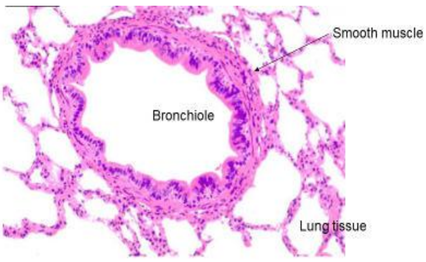


- The trachea typifies the conducting system.
- The cilia are paralyzed by cigarette smoke.
- At rest, smooth muscle contraction decreases tracheal (and bronchial) diameter to decrease respiratory dead space.

Continued.....

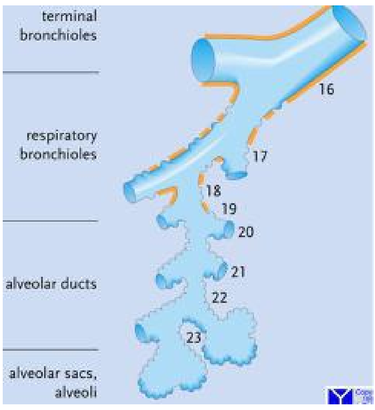
- Bronchioles - lumen of 1mm or less in diameter.
- The epithelium ciliated columnar.
- Cartilage and glands disappear
- Bronchiole is held open by the surrounding lung tissue.
- The smooth muscle in the wall may excessively narrow the lumen in asthma.

Bronchiole



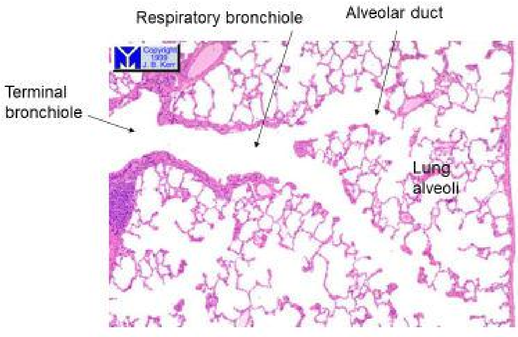
- Bronchioles with a lumen of 1 mm or less in diameter.
- Epithelium becomes ciliated columnar.
- Cartilage and glands disappear
- The bronchiole is held open by the surrounding lung tissue.
- The smooth muscle may excessively narrow the lumen in asthma.

Bronchiole



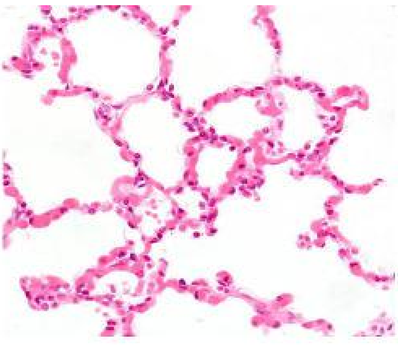
- Bronchioles continue to divide and decrease in size
- Terminal Bronchioles
- Respiratory Bronchioles , which give the alveolar ducts, alveolar sacs and alveoli.

Terminal and Respiratory Bronchioles



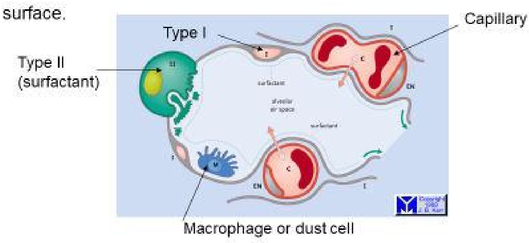
- Epithelium - non-ciliated cuboidal and goblet cells disappear.
- Gas exchange - in the respiratory alveoli
- That bud from the respiratory bronchioles.

Alveoli

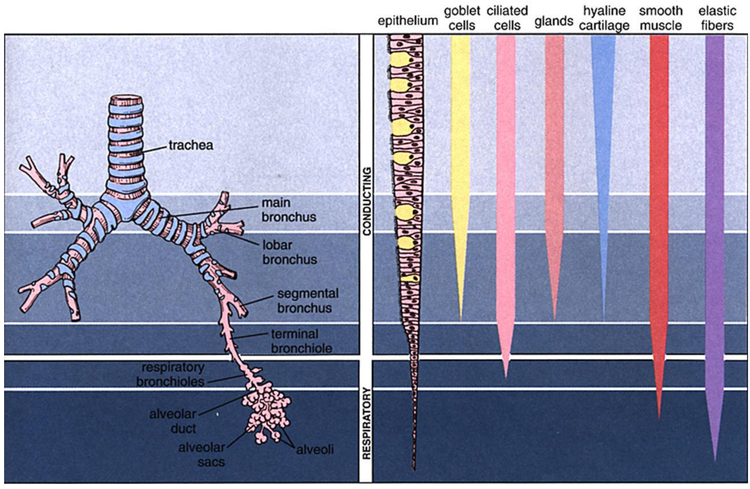


- The alveoli - functional unit
- Out-pocketings of respiratory bronchioles, alveolar ducts and alveolar sacs.
- The most conspicuous feature of the alveolar wall -Presence of many small capillaries in the septae between them.
- Opposite the septae the alveoli are open to allow air entry.

Epithelium



- Type I are the flattened epithelial cells (squamous pneumocytes) that have cytoplasmic extensions about 0.1 - 0.3 um thick and have no microvilli.
- In some areas the basal lamina of the type I cell is fused to the capillary
- Endothelium - possible areas of gas exchange.
- Type II, the large alveolar cells (granular pneumocytes) are cuboidal without broad cytoplasmic extensions and occupy about 5% of the alveolar surface.



Epithelium

- Type II Cells produce Surfactant, a stabilizing, surface-active material consisting mainly of the phospholipid lecithin.
- Surfactant is crucial to lung function
- Its high viscosity and low surface tension, stabilizes the diameter of alveoli preventing collapse after expiration, while retaining residual air in the alveoli after each breath;
- Because alveoli are already partially open, energy expenditure in subsequent inspirations is much less.

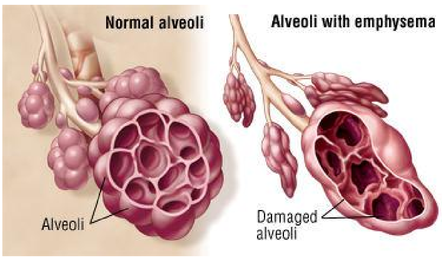
Continued....

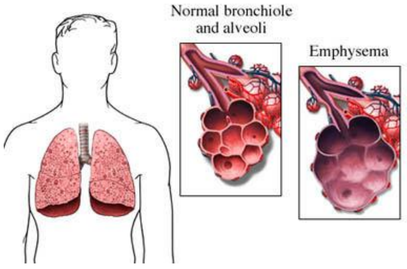
- Acting as a detergent surfactant facilitates the removal of amniotic fluid from the lungs at birth, before the first breath.
- Dust cells (macrophages) usually lie free in the alveoli and air passageways.
- Their role is to clear the lungs of invading bacteria and inspired particulate material (e.g. dust and carbon particles).

Summary

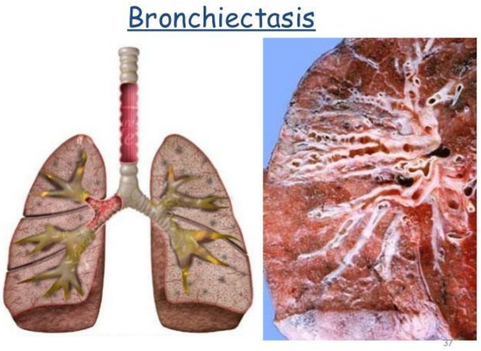
- Massive surface area for gas exchange (75 square metres)
- As lumen decreases so do cartilage, cilia, epithelial height and mucous
- Smooth muscle controls diameter, but excessively narrowing in asthma
- Surfactant is thick in polycystic fibrosis

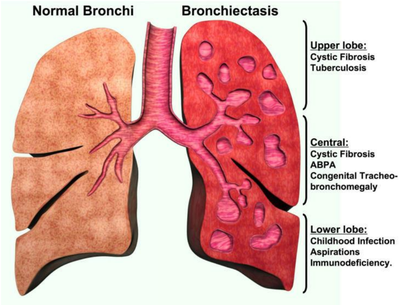
Emphysema





Bronchiectasis





MCQs

Question :- Which of the following is correct regarding Clara cell?

a. Ciliated secretory cuboidal cells
b. Present in larger terminal bronchiole
c. Present in smaller terminal bronchiole
d. Number decreases in small bronchiole