

1

The Respiratory System

- Supplies body with oxygen
- Disposes of carbon dioxide
- Four processes in respiration
 - **Pulmonary ventilation**
 - **External respiration**
 - **Transport of respiratory gases**
 - **Internal respiration**

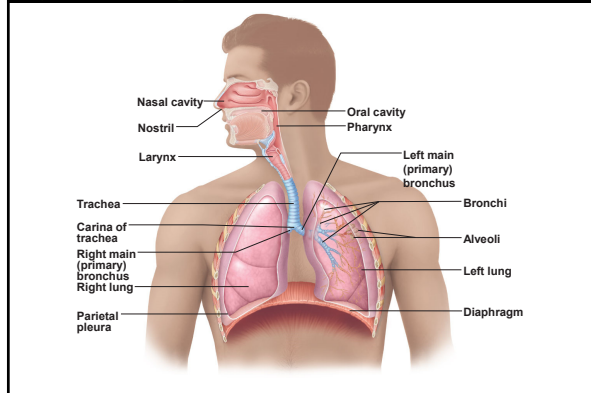
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Functional Anatomy of the Respiratory System

- **Respiratory organs**
 - Nose, nasal cavity, and paranasal sinuses
 - Pharynx, larynx, and trachea
 - Bronchi and smaller branches
 - Lungs and alveoli
- **Divided into:**
 - Conducting zone
 - Respiratory zone

3

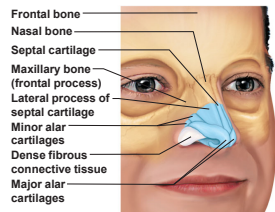
Organs of the Respiratory System



4

The Nose

- Provides an airway for respiration
- Moistens and warms air
- Filters inhaled air
- Resonating chamber for speech
- Houses olfactory receptors
- Size variation due to differences in nasal cartilages
- Skin is thin – contains many sebaceous glands



(b) External skeletal framework

Figure 22.2

5

The Nasal Cavity

- **External nares** – nostrils
 - Divided by – nasal septum
- Continuous with nasopharynx
 - Posterior nasal apertures – choanae

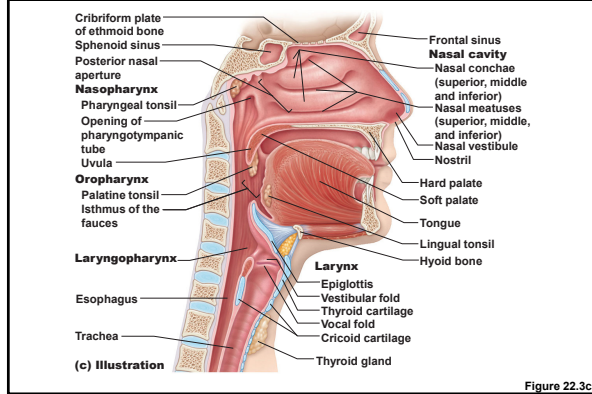
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Nasal Cavity

- Two types of mucous membrane
 - **Olfactory mucosa**
 - Near roof of nasal cavity
 - Houses olfactory (smell) receptors
 - **Respiratory mucosa**
 - Lines nasal cavity
 - Epithelium is pseudostratified ciliated columnar

7

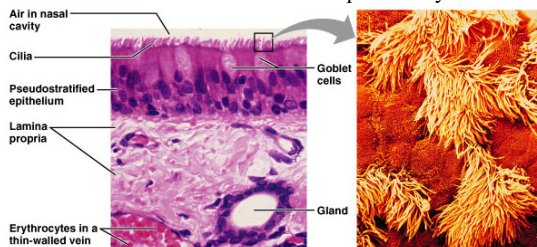
The Upper Respiratory Tract



8

Respiratory Mucosa

- **Consists of:**
 - Pseudostratified ciliated columnar epithelium
 - Goblet cells within epithelium
 - Underlying layer of lamina propria
- **Cilia** move contaminated mucus posteriorly



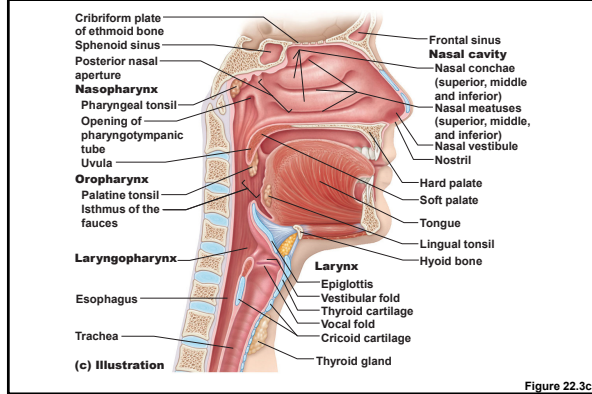
9

Nasal Conchae

- Superior and middle – part of the ethmoid bone
- **Inferior – a separate bone**
- Project medially from the lateral wall of the nasal cavity
- Particulate matter – deflected to mucus-coated surfaces

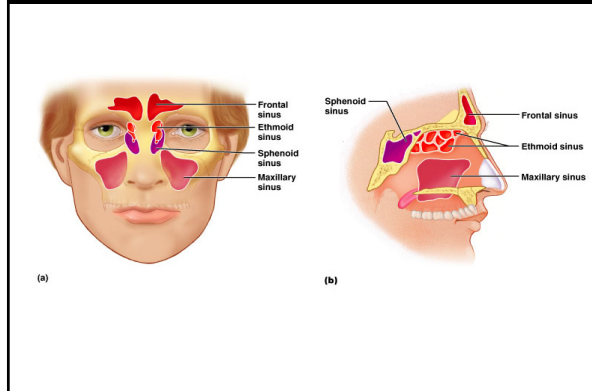
10

The Upper Respiratory Tract



11

The Paranasal Sinuses



12

The Pharynx

- Funnel-shaped passageway
- Connects nasal cavity and mouth
- Divided into three locations
 - **Nasopharynx, oropharynx, and laryngopharynx**
- Type of mucosal lining varies along its length

13

The Nasopharynx

- Superior to the point where food enters
- Only an air passageway
- Closed off during swallowing
- Pharyngeal tonsil (adenoids)
 - Located on posterior wall
 - Destroys entering pathogens
- Contains the opening to the pharyngotympanic (auditory) tube
- Epithelium is ciliated pseudostratified columnar

14

The Oropharynx

- Arch-like entranceway – fauces
- Extends from soft palate to the epiglottis
- Epithelium is stratified squamous epithelium
- Two types of tonsils in the oropharynx
 - Palatine tonsils – in the lateral walls of the fauces
 - Lingual tonsils – covers the posterior surface of the tongue

15

The Laryngopharynx

- Passageway for both food and air
- Lined with stratified squamous epithelium
- Continuous with the esophagus and larynx

16

The Upper Respiratory Tract

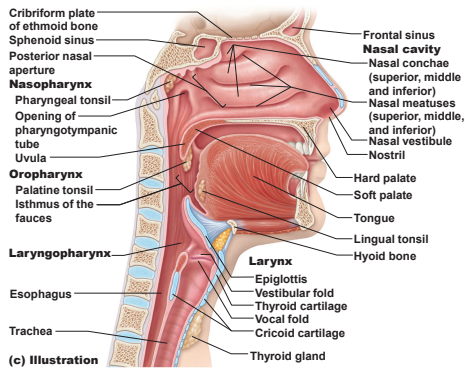
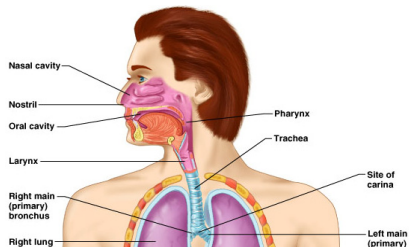


Figure 22.3c

17

The Larynx

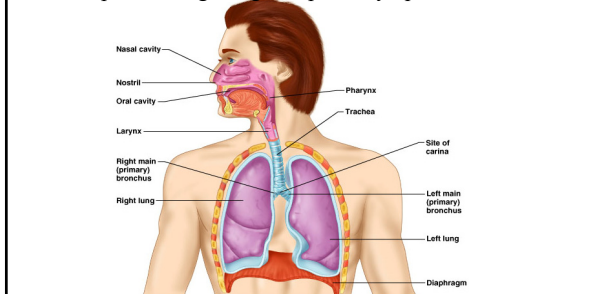
- **Three functions**
 - Voice production
 - Provides an open airway
 - Routes air and food into the proper channels



18

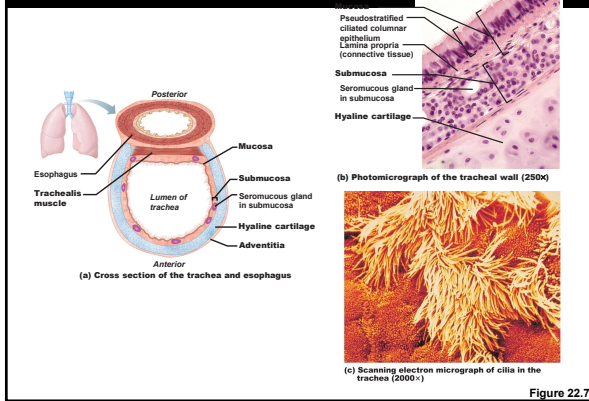
The Trachea

- Descends into the mediastinum
- Divides into two main bronchi
- C-shaped cartilage rings keep airway open



22

The Trachea



23

Bronchi in the Conducting Zone

- **Bronchial tree** – extensively branching respiratory passageways
- **Primary bronchi** (main bronchi) – largest bronchi
- **Right main bronchi** – wider and shorter than the left

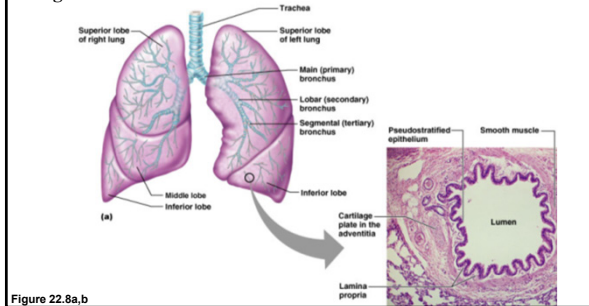


Figure 22.8a,b

24

Bronchi in the Conducting Zone

- **Secondary** (lobar) bronchi
 - Three on the right
 - Two on the left
- **Tertiary** (segmental) bronchi
 - Branch into each lung segment
- **Bronchioles** – little bronchi, less than 1 mm in diameter
- **Terminal bronchioles** – less than 0.5 mm in diameter

25

Changes in Tissue Composition along Conducting Pathways

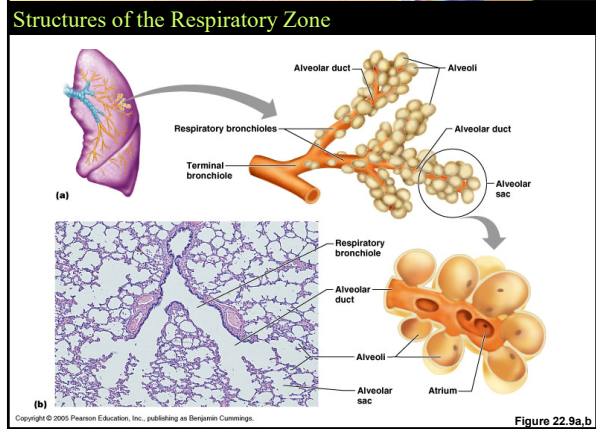
- **Supportive connective tissues change**
 - C-shaped rings replaced by cartilage plates
- **Epithelium changes**
 - First, pseudostratified ciliated columnar
 - Replaced by simple columnar, then simple cuboidal epithelium
- **Smooth muscle becomes important**

26

The Respiratory Zone

- **Consists of air-exchanging structures**
- **Respiratory bronchioles** – branch from terminal bronchioles
 - Lead to **alveolar ducts**
 - Lead to alveolar sacs

27

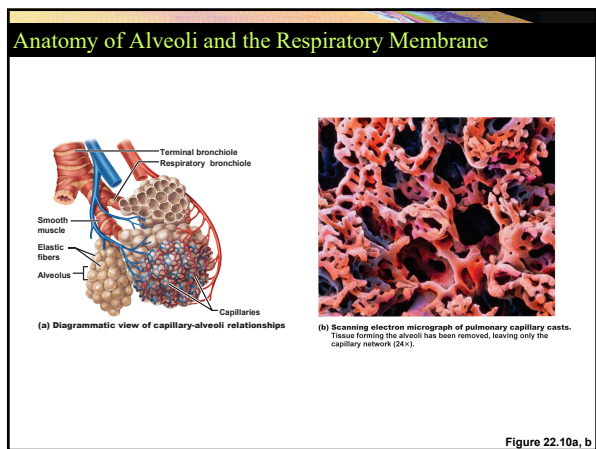


28

The Respiratory Zone

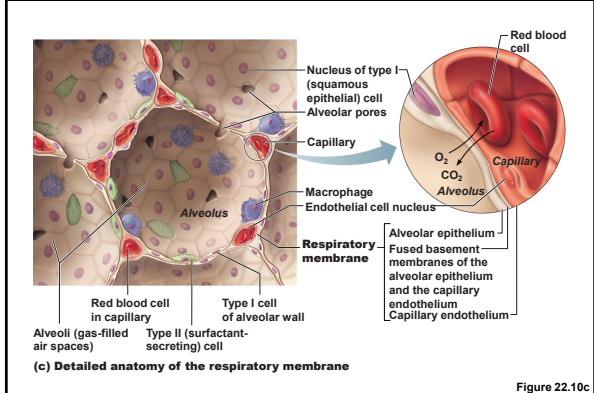
- Alveoli consist of type I cells and basal laminae
- Scattered among type I cells
 - Cuboidal epithelial cells – type II cells
 - Secrete surfactant

29



30

Anatomy of Alveoli and the Respiratory Membrane



31

The Respiratory Zone

- **Features of alveoli**
 - Surrounded by elastic fibers
 - Interconnect by way of alveolar pores
 - Internal surfaces
 - A site for free movement of alveolar macrophages

32

The Mechanisms of Ventilation

- **Two phases of pulmonary ventilation**
 - Inspiration – inhalation
 - Expiration – exhalation
- Air enters and exits the lungs based on air pressure.
 - Air flows from high pressure into an area of low pressure, passively.

33

Inspiration

- Volume of thoracic cavity increases
 - Decreases internal gas pressure
 - Action of the diaphragm – diaphragm flattens
 - Action of intercostal muscles – contraction raises the ribs
- Deep inspiration requires
 - Scalenes, sternocleidomastoid, and pectoralis minor
 - Erector spinae – extends the back

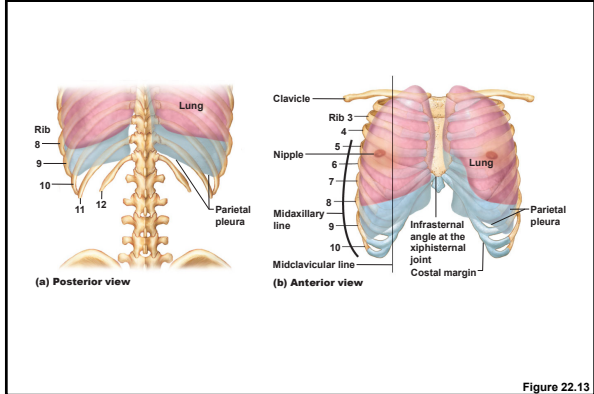
34

Expiration

- Quiet expiration – chiefly a passive process
 - Inspiratory muscles relax
 - Diaphragm moves superiorly
 - Volume of thoracic cavity decreases
- Forced expiration – an active process
 - Produced by contraction of:
 - The oblique and transversus abdominis muscles

35

Location of Lungs in Thoracic Cavity



36

