RESPIRATORY SYSTEM

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RESPIRATION

❖ The exchange of gases between the atmosphere, lungs, blood, and tissues

- Respiratory system; supply the body with oxygen and dispose of carbon dioxide, Passageways to the lungs purify, warm, and humidify the incoming air
- Respiration – four distinct processes must happen
  - **Pulmonary ventilation**=“breathing”, moving air into and out of the lungs
  - **External respiration**=occurs within the lungs, gas exchange between the lungs and the blood
  - **Transport of respiratory gases**=via the blood, transport of oxygen and carbon dioxide between the lungs and tissues
  - **Internal respiration**=occurs within the tissues, gas exchange between systemic blood vessels and tissues

Respiratory System Anatomy

- Structurally
  - **Upper respiratory system**
    - Nose, pharynx and associated structures,larynx
  - **Lower respiratory system**
    - Trachea, bronchi and lungs
- Functionally
  - **Conducting zone** – conducts air to lungs
    - Nose, pharynx, larynx, trachea, bronchi, bronchioles and terminal bronchioles
  - **Respiratory zone** – main site of gas exchange
    - Respiratory bronchioles, alveolar ducts, alveolar sacs, and alveoli

FUNCTIONAL ANATOMY

- ***Upper respiratory***

- Nose
- Pharynx
- Larynx (voice box)

- ***Lower respiratory***

- Trachea (Windpipe)
- Bronchial tree
- Lungs

Function of the Nose

- The only externally visible part of the respiratory system that functions by:
  - Providing an airway for respiration
  - Moistening (humidifying) and warming the entering air
  - Filtering inspired air and cleaning it of foreign matter
  - Serving as a resonating chamber for speech
  - Housing the olfactory receptors, (I cranial nerve), smelling

Structure of the Nose

- The nose is divided into two regions
  - The external nose, including the root, bridge, dorsum nasi, and apex
  - The internal nasal cavity
- The external nares (nostrils) are bounded laterally by the alae

Nasal Cavity

- Is divided by a midline nasal septum
- Opens posteriorly into the nasal pharynx via internal nares(choanae)
- The nasal cavity is separated from the oral cavity by the palate
  - Anterior hard palate (bone)
  - Posterior soft palate (muscle)
- Olfactory mucosa
  - Lines the superior nasal cavity
  - Contains smell receptors

Anatomy of the Nasal Cavity

- Ciliated mucosal cells remove contaminated mucus
- Ducts from paranasal sinuses and nasolacrimal ducts open into internal nose
- Lateral walls have projections called conchae
  - Increases surface area
  - Increases air turbulence within the nasal cavity

Paranasal Sinuses

- Cavities within bones surrounding the nasal cavity
  - **Frontal bone**
  - **Sphenoid bone**
  - **Ethmoid bone**
  - **Maxillary bone**

- Function of the sinuses
  - Lighten the skull
  - Act as resonance chambers for speech
  - Produce mucus that drains into the nasal cavity

Pharynx

- Passageway for air and food
- Extends from the base of the skull to the level of the sixth cervical vertebra
- It is divided into three regions
  - Nasopharynx
  - Oropharynx
  - Laryngopharynx

Nasopharynx

- Lies posterior to the nasal cavity, inferior to the sphenoid, and superior to the level of the soft palate
- Closes during swallowing to prevent food from entering the nasal cavity
- The pharyngeal tonsil lies high on the posterior wall
- Pharyngotympanic (auditory) tubes open into the lateral walls

Oropharynx (fauces)

- Extends inferiorly from the level of the soft palate to the epiglottis (larinx)
- Opens to the oral cavity via an archway called the fauces
- Serves as a common passageway for food and air
- Palatine tonsils lie in the lateral walls of the fauces
- Lingual tonsil covers the base of the tongue

Laryngopharynx

- Serves as a common passageway for food and air
- Lies posterior to the upright epiglottis (larinx)
- Extends to the larynx, where the respiratory and digestive pathways diverge

Structures of the Pharynx

- Auditory tubes enter the nasopharynx
- Tonsils of the pharynx (Houses tonsils)
  - Pharyngeal tonsil (adenoids) in the nasopharynx
  - Palatine tonsils in the oropharynx
  - Tubal tonsils where Auditory tubes enter the nasopharynx

Larynx (Voice Box)

- Continuous with the trachea posteriorly
- The three functions of the larynx are:
  - To provide a patent airway
  - To act as a switching mechanism to route air and food into the proper channels
  - To function in voice production

Framework of the Larynx

- Cartilages (hyaline) of the larynx
  - Shield-shaped anterosuperior **thyroid cartilage** with a midline laryngeal prominence (Adam's apple)
  - Single ring–shaped anteroinferior **cricoid cartilage**
  - Three pairs of small **arytenoid**, **cuneiform,** and **corniculate cartilages**
- **Epiglottis** – elastic cartilage that covers the laryngeal inlet during swallowing

Vocal Ligaments

- Attach the **arytenoid cartilages to the thyroid cartilage**

- Composed of elastic fibers that form mucosal folds called **true vocal cords**
  - The medial opening between them is the **glottis**
  - They vibrate to produce sound as air rushes up from the lungs

- **False vocal cords**
  - Mucosal folds superior to the true vocal cords
  - Have no part in sound production

Trachea (Windpipe)

- Connects larynx with bronchi
- Extends from larynx to superior border of T5
  - Divides into right and left primary bronchi
- Walls are reinforced with C-shaped hyaline cartilage

Features of the Bronchial Tree

- **Primary Bronchi:**
  - Formed by division of the trachea. Right bronchus is wider, shorter, and straighter than left (Aspiration)
- **Secondary Bronchi:**
  - Each primary divides into secondary (3 on right and 2 on left) bronchi that service each lung
- **Tertiary Bronchi:**
  - Secondary bronchi branch into tertiary which branch into smaller and smaller tubes
- **Bronchioles:**
  - Tiniest of tertiary bronchi, less than 0.5 mm in diameter; smallest are terminal bronchi

Features of the Lower Bronchial Tree

- **Terminal Bronchioles:**
  - The smallest bronchioles that feed directly into:
- **Respiratory Bronchioles:**
  - Feed into each lung which lead into (gas exchange):
- **Alveolar ducts:**
  - Contain rings of smooth muscle and **alveoli** which is the structure gases are exchanged in.

Respiratory Tree Divisions

- Primary bronchi
- Secondary bronchi
- Tertiary bronchi
- Bronchioli
- Terminal bronchioli

Respiratory Zone

- Respiratory bronchioli
- Alveolar duct
- **Alveoli**
- **Site of gas exchange!!!**

LUNGS

- Lungs are **organs of respiration**
- Their main function is **to oxygenate the blood** by bringing the inspired air into close relation with the venous blood in the pulmonary capillaries

Gross Anatomy of the Lungs

- **Lungs occupy all of the thoracic cavity except the mediastinum**
  - **Costal surface** – anterior, lateral, and posterior surfaces in contact with the ribs
  - **Mediastinal surface**
  - **Diaphragmatic surface**

  - **Apex** – narrow superior tip
  - **Base** – inferior surface that rests on the diaphragm
  - **Hilus** – indentation that contains pulmonary and systemic blood vessels

- **Left lung** – separated into **upper and lower lobes** by the oblique fissure
- **Right lung** – separated **into three lobes** by the oblique and horizontal fissures

- There are 10 bronchopulmonary segments in each lung

Mediastinal Surface of Lungs

- Blood vessels & airways enter lungs at **hilus**
- Forms **root** of lungs
- Covered with **pleura** (parietal becomes visceral)

Pleurae

- Thin, double-layered serosa
- **Parietal pleura**
  - Covers the thoracic wall and superior face of the diaphragm
- **Visceral, or pulmonary, pleura**
  - Covers the external lung surface
  - **Pleural cavity** is **space** between layers
    - Contains a capillary layer of **serous fluid**
    - **Lubrication** of the pleural surfaces allow the two layers slide on each other smoothly during lung movements

Breathing

- Breathing, or pulmonary ventilation, consists of two phases
  - **Inspiration** – air flows into the lungs
  - **Expiration** – gases exit the lungs

Inspiration

- DİAPHRAGM AND EXTERNAL İNTERCOSTAL MUSCLES CONTRACT
- THE SİZE OF THE THORACİC CAVİTY İNCREASES
- EXTERNAL AİR İS PULLED İNTO THE LUNGS DUE TO AN İNCREASE İN İNTRAPULMONARY VOLUME

Expiration

- Passive process dependent up on natural lung elasticity
- As muscles relax, air is pushed out of the lungs

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