The Respiratory System

Respiratory system functions mainly as gas exchange system for $O_2$ and $CO_2$ → **cellular respiration** (energy production)

closely tied to circulatory system

**General Functions of Respiratory System:**
1. $O_2$ and $CO_2$ exchange between blood and air
2. speech and vocalization
3. sense of smell
4. helps control acid base balance of body
5. breathing movements help promote blood and lymph flow

air conducting passageways must be held open at all times

→ nasal passageways and throat follow passages in skull bones and cartilage

→ others held open by rings of cartilage

**Principal Organs of Respiratory System**
- nose
- pharynx
- larynx
- trachea
- primary bronchi
- lungs:
  - bronchioles
  - alveoli/respiratory membrane

these organs can also be subdivided into:

- **conducting division**
  - passageways that serve only for airflow

- **respiratory division**
  - alveoli and gas exchange areas

and

- **upper respiratory tract**
  - nose → pharynx → larynx
- **lower respiratory tract**
  - respiratory organs of the thorax

the lower respiratory tract fills most of the **Thorax (Thoracic Cavity)**
major portion is occupied by **lungs**

**Lungs**

located in pleura cavity

visceral pleura covers outer surface of lungs

additional space given to heart

all organs between the two lungs are located in the **mediastinum**

mediastinum includes:

heart
- heart is in its own sac = pericardium
esophagus
trachea
major blood vessels attached to heart

the **pleurae** and **pleural fluid**:

1. help reduce friction
   act as a lubricant
   **pleurisy**=pleurae are dry and inflamed

2. create a pressure gradient
   as rib cage expands to draw air into the lungs

3. compartmentalization
   surround each lung and isolate it from other and
   pericardial sac
   prevent infections from spreading easily from one
   thoracic organ to another

1. **Nose**
   separated from mouth by hard and soft palate

   cleft palate – bones don’t unite completely
   produces difficulties in swallowing

   each nasal cavity is divided into 3 passageways by **turbinates**

   → creates narrow, turbulent passageways to insure that all
   air makes contact with mucous membranes
membranes are heavily vascularized

→ remove bacteria, debris and particles

→ warms and moisturizes air entering lungs

→ also contains receptors for smell

nasolacrimal ducts drain into nasal cavity

paranasal sinuses are accessory structures:

- sound resonance (other animals)
- warm and moisten air
- lighten skull

2. **Pharynx (throat)**

from base of skull to junction with esophagus and trachea

5" long

made of muscle and lined with mucous membrane

junction between digestive and respiratory systems

divided into three regions:

a. **Nasopharynx**

behind nose to level of soft palate
includes uvula
tonsils (adenoids)
auditory tube (eustachian tube) drains here

b. **Oropharynx**

behind mouth
from soft palate to level of hyoid bone
palatine and lingual tonsils

c. **Laryngopharynx**

from hyoid bone to esophagus/larynx

3. **Larynx (voice box)**

enlarged beginning portion of trachea

composed of cartilage and muscles
opening into larynx = **glottis**

functions:
prevent food from entering lower respiratory system
sound → speech, singing, etc

9 cartilages (3 large, 6 small):

**epiglottis** – covers glottis when swallowing

**thyroid cartilage**

largest cartilage of larynx

testosterone stimulates the growth of the laryngeal prominence so it becomes larger in males than in females = **adam’s apple**

**cricoid cartilage**

smaller cartilage below thyroid
connects larynx to trachea

two muscular folds within larynx:
upper: (false) vocal cords (=vestibular folds)
close glottis during swallowing

lower: (true) vocal cords

4. **Trachea**

extends from larynx to bronchi

surrounded by “C” – shaped bands of cartilage
ends joined by bands of muscle tissue

→ holds walls open, prevents collapse

lined by pseudostratified ciliated columnar epithelium

5. **Bronchi**

trachea divides into two branches = **bronchi**
which enter each lung

**Lung**
right lung has 3 lobes
left lung has 2 lobes

bronchi resemble trachea in structure
→ also supported by C-shaped cartilages

also have lots of elastic connective tissue

each bronchus enters lung and continues to divide into smaller and smaller branches = bronchi, then = bronchioles

because of the extensive branching = bronchial tree

two primary bronchi
branches into 5 secondary bronchi (1 for each lobe of lung)
each of these branches into tertiary bronchi

secondary and tertiary bronchi kept open by complete rings of cartilage

6. Bronchioles

smallest branches of “respiratory tree”

<1mm diameter

no supportive cartilage

Alveoli

smallest bronchioles (respiratory bronchioles) have clusters of tiny sacs branching off = alveoli

“grapelike clusters”

300-500 Million alveoli/lung

single cell layer thick (squamous epithelium)
enveloped by capillaries

are functional unit of respiratory system

actual site of gas exchange with blood