The Respiratory System

Respiration Includes

- **Pulmonary ventilation**
  - Air moves in and out of lungs
  - Continuous replacement of gases in alveoli (air sacs)
- **External respiration**
  - Gas exchange between blood and air at alveoli
  - O2 (oxygen) in air diffuses into blood
  - CO2 (carbon dioxide) in blood diffuses into air
- **Transport of respiratory gases**
  - Between the lungs and the cells of the body
  - Performed by the cardiovascular system
  - Blood is the transporting fluid
- **Internal respiration**
  - Gas exchange in capillaries between blood and tissue cells
  - O2 in blood diffuses into tissues
  - CO2 waste in tissues diffuses into blood
Cellular Respiration

- Oxygen (O2) is used by the cells
- O2 needed in conversion of glucose to cellular energy (ATP)
- All body cells
- Carbon dioxide (CO2) is produced as a waste product
- The body’s cells die if either the respiratory or cardiovascular system fails

The Respiratory Organs

Conducting zone
- Respiratory passages that carry air to the site of gas exchange
- Filters, humidifies and warms air

Respiratory zone
- Site of gas exchange
- Composed of
  - Respiratory bronchioles
  - Alveolar ducts
  - Alveolar sacs
Nose

- Provides airway
- Moistens and warms air
- Filters air
- Resonating chamber for speech
- Olfactory receptors

Nasal cavity

- Air passes through nares (nostrils)
- Nasal septum divides nasal cavity in midline (to right & left halves)
  - Perpendicular plate of ethmoid bone, vomer and septal cartilage
  - Connects with pharynx posteriorly through choanae (posterior nasal apertures*)
- Floor is formed by palate (roof of the mouth)
  - Anterior hard palate and posterior soft palate
Linings of nasal cavity

- Vestibule* (just above nostrils)
  - Lined with skin containing sebaceous and sweat glands and nose hairs
  - Filters large particulars (insects, lint, etc.)
- The remainder of nasal cavity: 2 types of mucous membrane
  - Small patch of olfactory mucosa near roof (cribriform plate)
  - Respiratory mucosa: lines most of the cavity

Respiratory Mucosa

- Pseudostratified ciliated columnar epithelium
- Scattered goblet cells
- Underlying connective tissue lamina propria
  - Mucous cells – secrete mucous
  - Serous cells – secrete watery fluid with digestive enzymes, e.g. lysozyme
- Together all these produce a quart/day
  - Dead junk is swallowed
Nasal Conchae

- Inferior to each is a meatus*
- Increases turbulence of air
- 3 scroll-like structures
- Reclaims moisture on the way out
Paranasal sinuses

- Frontal, sphenoid, ethmoid and maxillary bones
- Open into nasal cavity
- Lined by same mucosa as nasal cavity and perform same functions
- Also lighten the skull
- Can get infected: sinusitis

The Pharynx (throat)

- 3 parts: naso-, oro- and laryngopharynx
- Houses tonsils (they respond to inhaled antigens)
- Uvula closes off nasopharynx during swallowing so food doesn’t go into nose
- Epiglottis posterior to the tongue: keeps food out of airway
- Oropharynx and laryngopharynx serve as common passageway for food and air
  - Lined with stratified squamous epithelium for protection
The Larynx (voicebox)

- Extends from the level of the 4th to the 6th cervical vertebrae
- Attaches to hyoid bone superiorly
- Inferiorly is continuous with trachea (windpipe)
- Three functions:
  1. Produces vocalizations (speech)
  2. Provides an open airway (breathing)
  3. Switching mechanism to route air and food into proper channels
     - Closed during swallowing
     - Open during breathing

Framework of the larynx

- 9 cartilages connected by membranes and ligaments
- Thyroid cartilage with laryngeal prominence (Adam’s apple) anteriorly
- Cricoid cartilage inferior to thyroid cartilage: the only complete ring of cartilage: signet shaped and wide posteriorly
- Behind thyroid cartilage and above cricoid: 3 pairs of small cartilages
  1. **Arytenoid**: anchor the vocal cords
  2. Corniculate
  3. Cuneiform
- 9<sup>th</sup> cartilage: epiglottis
Epliglottis* (the 9th cartilage)
Elastic cartilage covered by mucosa
On a stalk attached to thyroid cartilage
Attaches to back of tongue
During swallowing, larynx is pulled superiorly
Epiglottis tips inferiorly to cover and seal laryngeal inlet
Keeps food out of lower respiratory tract

Cough reflex: keeps all but air out of airways
Low position of larynx is required for speech (although makes choking easier)
Paired vocal ligaments: elastic fibers, the core of the true vocal cords