BIO 2402 - Human Anatomy & Physiology
Week 10

Hi everyone! I hope your second exam went well! This week we are going to be focusing on the respiratory system. I have broken things down into the anatomical portions of the upper and lower respiratory tracts, and then the physiology of lung capacity, respiration, and air pressure. Please let me know if you have any questions!

Remember that the Tutoring Center offers free individual and group tutoring for this class. Our Group Tutoring sessions will be every Wednesday from 6:00-7:00 PM CST. You can reserve a spot at https://baylor.edu/tutoring.

KEY TERMS: Upper Respiratory Tract, Lower Respiratory Tract, Dalton's Law, Charles Law, Bohr Effect, Haldane Effect

Upper Respiratory Tract: Nose, nasal passages, pharynx, and the larynx

Lower Respiratory Tract: trachea, bronchial trees, lungs

1. Nose
   a. Fibrous connective tissue
   b. Lateral, septal, alar cartilage
   c. Nostrils/External Nares: dense fibrous connective tissue
   d. Nasal Vestibule: Superior to nostrils, stratified squamous epithelium. Contains nasal hairs.
2. Nasal Cavity
   a. Superior and posterior to nasal vestibule.
   b. Nasal septum: vomer(inferior) & perpendicular plate(upper)
   c. Maxilla & Palatine: form floor of nasal cavity
   d. Maxilla & Nasal Conchae/turbinate bones: form lateral walls
   e. Ethmoid Cribriform & Frontal Bone: form roof
   f. Sphenoid bones: form posterior walls
      i. Olfactory Mucosa: superior portion of cavity

      Nonciliated, pseudostratified columnar epithelium w/olfactory cells

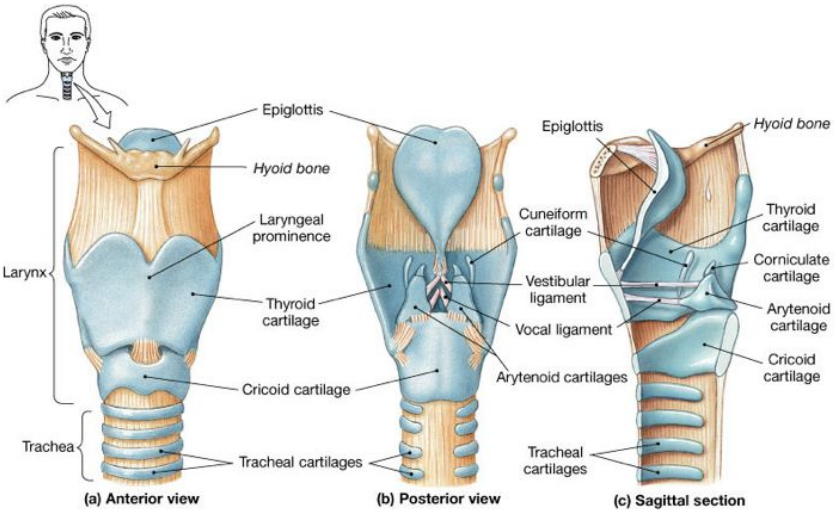
      ii. Respiratory Mucosa: remainder of the cavity

      Ciliated, pseudostratified columnar epithelium w/goblet cells

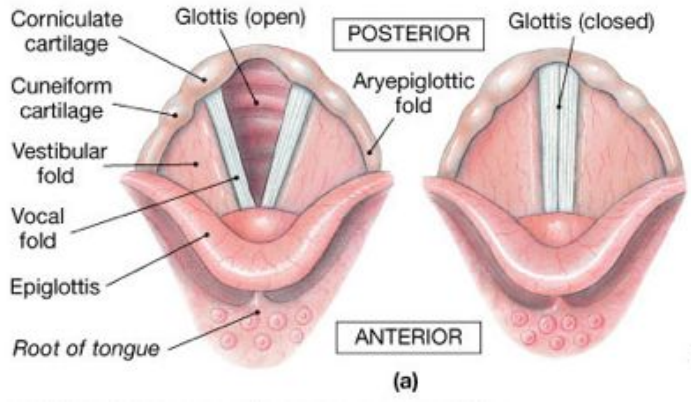
3. **Pharynx**
   a. Muscular tube between nasal cavity & larynx
      i. **Nasopharynx**: ciliated pseudostratified columnar epithelium w/goblet cells
         1. Separated from nasal cavity by internal nares
         2. Contains opening to the auditory/eustachian tubes
         3. Soft palate & uvula separate the nasopharynx from the oral cavity.
      ii. **Oropharynx:** stratified squamous epithelium
         1. Palatine & lingual tonsils
      iii. **Laryngopharynx:** posterior to oropharynx

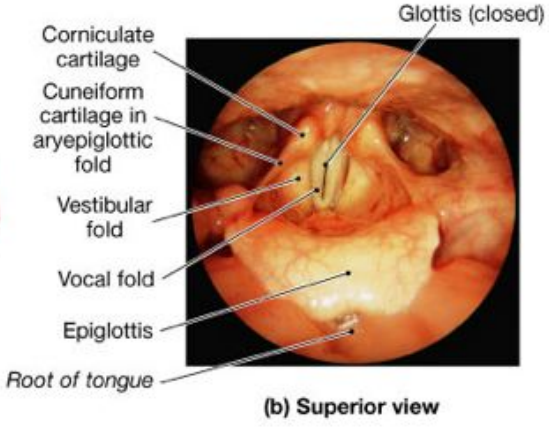
All images are taken from Dr. Taylor's textbook

4. **Larynx(voice box/adam's apple)**: most inferior organ in the upper respiratory tract
   a. Primarily hyaline cartilage
      i. Anterior: thyroid cartilage
      ii. Inferior: Cricoid cartilage
   b. Suspended from the hyoid bone by thyrohyoid membrane
   c. Laryngeal inlet: opening into vestibule
   d. Laryngeal vestibule: cavity w/in larynx
      i. Cuneiform cartilage: elastic cartilage
      ii. Corniculate cartilage
      iii. Arytenoid cartilage



5. Glottis and Epiglottis
   a. Form the inferior portion of the laryngeal vestibule
   b. Know which muscles regulate glottis diameter





6. **Trachea**: aka the windpipe
   a. Connects the larynx to the bronchi
   b. Contains the carina: responsible for coughing
   c. Primarily composed of ciliated pseudostratified columnar epithelium w/goblet cells and covered externally by adventitia (areolar connective tissue)
   d. C-shaped rings of hyaline cartilage
   e. Trachealis muscle is on the posterior side (elastic tissue & smooth muscle)

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7. Muscles for Inhalation & Exhalation
   a. **Inhalation**
      i. Restful: diaphragm & external intercostals
      ii. Forced: scalenes, sternocleidomastoids, pectoralis minor
   b. **Exhalation**
      i. Restful: no muscles used
      ii. Forced: internal intercostals, external & internal obliques, transverse & rectus abdominis

8. **Lungs**
   a. Stroma: elastic tissue surrounding alveoli
   b. Bronchi & Bronchioles
      i. **Primary Bronchi**: cartilaginous rings, lined w/ciliated pseudostratified columnar epithelium
      ii. **Secondary/Tertiary Bronchi**: cartilaginous plates, more smooth muscle & lined w/simple columnar or cuboidal epithelium
      iii. **Terminal & Respiratory Bronchioles**
         1. Respiratory Bronchioles: house alveoli
            a. Alveolar ducts → Alveolar sacs → Alveoli
               i. Site of external respiration
                  1. Type I cells: simple squamous epithelium
                  2. Type II/Septal Cells: secrete surfactant

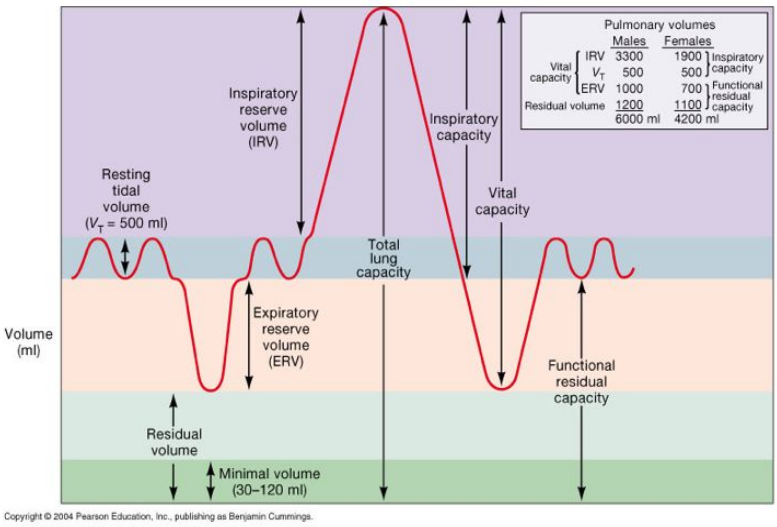
9. Graph w/lung capacities
   a. Intrapulmonary(Intraalveolar) pressure: w/in lungs or alveoli
   b. Intrapleural pressure: w/in pleural cavities, 4mm Hg less than intrapulmonary
   c. Atmospheric pressure: outside the body

Inhalation: atmospheric > intraalveolar > intrapleural

Exhalation: atmospheric < intraalveolar > intrapleural

Pneumothorax: intrapleural > intraalveolar

The image to the right references the different pulmonary volumes. This image is not as important for lecture, but knowing how to identify the different volumes on this image. I would recommend using flashcards to memorize these.



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10. Hyperventilation (the image below depicts hyperventilation when swimming)
    a. Excessive breathing which dramatically lowers the CO2 & H+ levels in the blood, causing vasoconstriction in the brain and vasodilation in the systemic vessels resulting in a decrease in blood pressure
        i. More sensitive to low CO2 levels than O2 levels swimming & hyperventilation)
    b. Causes fainting

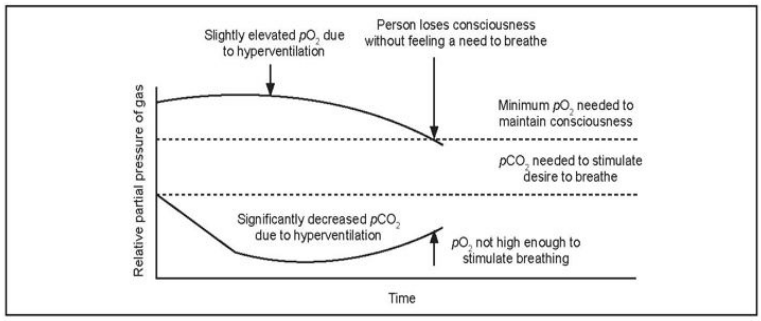

Figure 9-16. Danger of hyperventilating when swimming

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11. Gas Laws: these gas laws represent how pressure, solubility, and temperature affect air entering and leaving the lungs.
    a. Henry's Law: partial pressure & solubility correlate positively w/the amount of gas dissolved
    b. Dalton's Law: each gas has its own partial pressure
    c. Charles' Law: volume of gas correlates positively to the temperature *amount of gas correlates negatively w/the temperature*
    d. Boyle's Law: pressure correlates negatively w/the volume

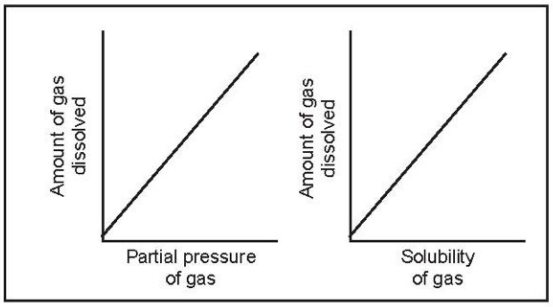


Figure 9-9. Henry's law and gas in solution

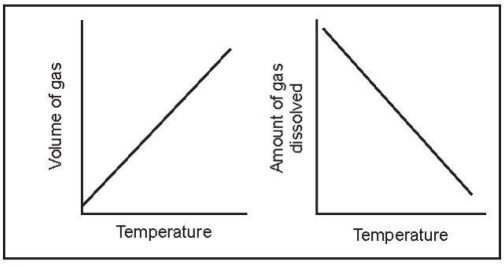
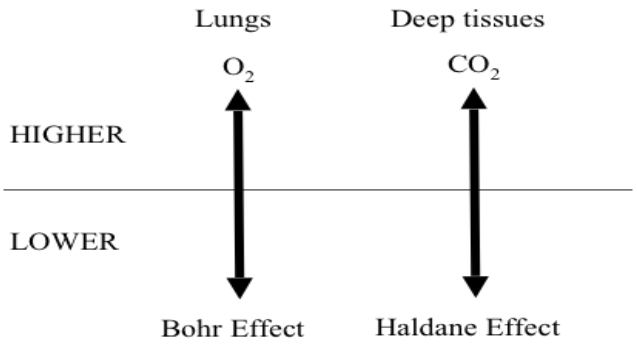


Figure 9-10. Charles' law and gas in solution

Affinity for O2/CO2

    e. Bohr Effect: Hb's low affinity for O2 in high CO2/H+ environments
    f. Haldane Effect: HHb's high affinity for CO2

The image to the right depicts the movement of O2/CO2 in different locations.



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