Respiratory System Video Outline

I. Functions of the respiratory system
   A. Gas exchange
      1. Supply of oxygen
      2. Removal of waste CO2
   B. Moisten, warm and filter the inspired air
   C. Other functions
      1. Regulation of blood pH
      2. Vocalization
      3. Defense against inhaled foreign matter
      4. Smell

II. General respiratory process
   A. Pulmonary ventilation (breathing)
   B. External respiration
      1. Exchange of gases between the air sacs and pulmonary capillaries
   C. Transport of blood gases via the cardiovascular system
   D. Internal respiration
      1. Exchange of gases between the systemic capillaries and the cells

Upper Respiratory Tract

III. Nose
   A. External framework
      1. Bones
         a. Nasal bones
         b. Maxillary bones
      2. Cartilage
         a. Lateral cartilage
         b. Lesser alar cartilage
         c. Greater alar cartilage plate
      3. Dense fibrous connective tissue
   B. Nasal septum divides nose into two chambers
      1. Bones
         a. Ethmoid bone
         b. Vomer bone
      2. Hyaline cartilage
   C. Nasal cavity
      1. Functions
         a. Transport air to pharynx and beyond
         b. Filter, warm and moisten the air
      2. External nares or nostril
      3. Vestibule (contains hairs)
      4. Roof of nasal cavity
         a. Bones
            i. Sphenoid bone
            ii. Ethmoid bone (includes cribriform plate)
         b. Olfactory mucosa with receptors
      5. Floor of nasal cavity
         a. Hard palate
            i. Maxillary
            ii. Palatine
         b. Soft palate
            i. Uvula
      6. Sides of nasal cavity
         a. Superior and middle concha of ethmoid bone
         b. Inferior conchae
         c. Superior, middle and inferior meatus
D. Respiratory mucosa
   1. Pseudostratified ciliated columnar epithelium overlying connective tissue
   2. Goblet cells produce mucus
   3. Cilia sweep mucus and trapped debris to pharynx where it is swallowed
   4. Blood vessels in underlying connective tissue warm the air

IV. Paranasal sinuses
   A. Function: warm and moisten inspired air
   B. Locations
      1. Maxillary sinuses
      2. Ethmoid sinuses
      3. Frontal sinus
      4. Sphenoid sinus
   C. Drain mucus through openings into the nasal cavity

V. Pharynx
   A. Transports air and food
   B. Nasopharynx
      1. Posterior to nasal cavity
      2. Extends to level of soft palate
      3. Usually air only
      4. Auditory tubes open into this area
      5. Pharyngeal tonsils (adenoids) on posterior wall
      6. Lined with pseudostratified ciliated columnar epithelium
   C. Oropharynx
      1. Behind oral cavity, between soft palate and hyoid bone
      2. Air and food
      3. Palatine and lingual tonsils
      4. Lined with non keratinized stratified squamous epithelium

D. Laryngeopharynx
   1. Extends from the hyoid bone to the larynx (anterior) and esophagus (posterior)
   2. Air and food
   3. Lined with non keratinized stratified squamous epithelium

Lower Respiratory Tract

VI. Larynx
   A. Covered anteriorly by thyroid gland
   B. Connects laryngeopharynx to trachea
   C. Thyrohyoid membrane connects laryngeal cartilages to hyoid bones
   D. Nine cartilages
      1. Thyroid cartilage (unpaired)
         a. Largest of the nine
         b. Adam's apple
      2. Cricoid cartilage (unpaired)
         a. Attached to thyroid by cricothyroid ligament
         b. Ring shaped
         c. Seen most easily in posterior view
      3. Arytenoid cartilages (paired)
         a. Triangular shape
         b. Superior to cricoid cartilage
         c. Attach to vocal cords and important in vocalization
      4. Corniculate cartilages (paired)
         a. Situated on the arytenoid cartilages
      5. Cuneiform cartilages (paired)
         a. Anterior to corniculate cartilages
         b. Aryepiglottic fold
      6. Epiglottis (unpaired)
         a. Attaches to anterior rim of thyroid cartilage
E. Vocal cords
   1. Vestibular folds AKA false vocal cords (superior)
      a. Little or no involvement in vocalization
   2. Vocal folds AKA true vocal cords (inferior)
      a. Elastic tissue ligaments
      b. Glottis
   3. Ventricle
      a. Space located between the vestibular folds and the vocal folds

F. Lining above vocal folds is non keratinized stratified squamous epithelium
G. Lining below vocal folds is pseudostratified ciliated columnar epithelium

VII. Trachea and primary bronchi
   A. 4-6" long inferior continuation of larynx
   B. Carina
      1. Right primary bronchus is shorter, wider, and more vertical
      2. Inhaled objects more commonly found in right bronchus
   C. 16-20 incomplete cartilage rings
      1. Trachealis muscle posteriorly
   D. Lined with pseudostratified ciliated columnar epithelium

VIII. Lungs
   A. Protected by ribs
   B. Surrounded by double walled serous sac
      1. Parietal pleura
         a. Tightly adheres to the muscles of the thorax and to the diaphragm
      2. Visceral pleura
         a. Lies directly on the lungs
      3. Pleural fluid reduces friction
   C. General anatomy of a lung
      1. Apex (superior pole)
      2. Diaphragmatic surface
      3. Costal surface
      4. Mediastinal surface
      5. Separated into lobes by deep fissures
   D. Right lung
      1. Larger, with three lobes
      2. Superior lobe
         a. Horizontal fissure separates it from middle lobe
      3. Middle lobe
         a. Oblique fissure separates it from middle lobe
      4. Inferior lobe
   E. Left lung
      1. Smaller than the right
      2. Cardiac notch
      3. Superior lobe
         a. Oblique fissure separates it from inferior lobe
      4. Inferior lobe
   F. Compartmentalization of lungs
      1. Bronchopulmonary segments
         a. 10 per lung
         b. Separated by connective tissue
         c. Each has its own vascular and airway supply
         d. May prevent spread of disease beyond a single segment
      2. Bronchopulmonary segments are further separated into lobules
IX. Bronchial tree
   A. Conducting zone
      1. Cleanse, warm and humidify air – NO GAS EXCHANGE
      2. Primary bronchi (right and left)
      3. Secondary or lobar bronchi
         a. Each supplies one lung lobe
         b. Three on right
         c. Two on left
      4. Tertiary or segmental bronchi
         a. Each supplies one bronchopulmonary segment
      5. 23 orders of branching
      6. Bronchiole – diameter less than 1 mm
      7. Smallest branches are less than 0.5 mm called terminal bronchioles
      8. Lined with pseudostratified ciliated columnar epithelium
   B. Respiratory zone
      1. Passageways contribute to gas exchange
      2. Respiratory bronchioles
         a. Recognized by outpocketings of alveoli along these bronchioles
      3. Alveoli
         a. Alveolar ducts
         b. Alveolar sacs (clusters of alveoli)
         c. 300,000,000 (300 million) alveoli, each about 0.3 mm in diameter
      4. Pulmonary arteriole, venule, and capillary bed

X. Alveolar-capillary membrane and respiratory gas exchange
   A. Type 1 alveolar cells
      1. Simple squamous epithelium
      2. Rest on a thin basement membrane containing elastic fibers
   B. Type 2 alveolar cells
      1. Secrete surfactant
      2. Decrease surface tension
   C. Macrophages or dust cells
      1. Phagocytosis of foreign matter
   D. Capillary endothelial cell
      1. Lies on a thin basement membrane
   E. Alveolar capillary membrane
      1. Very thin
      2. Type 1 alveolar cell, capillary endothelium and their fused basement membranes
      3. Also called air-blood barrier
      4. Exchange of gases occurs by simple diffusion
   F. Pulmonary edema
      1. Interstitial space becomes swollen with fluid
      2. Separates alveoli and capillaries
      3. Gas exchange rate slows