# The respiratory system

The Respiratory System STRUCTURAL PLAN Basic plan of respiratory system would be similar to an inverted tree if it were hollow; leaves of the tree would be comparable to alveoli, with the microscopic sacs enclosed by networks of capillaries (Figure 14-1) Passive transport process of diffusion is responsible for the exchange of gases that occur during respiration. RESPIRATORY TRACTS Upper respiratory tract–nose, pharynx, and larynx Lower respiratory tract–trachea, bronchial tree, and lungs RESPIRATORY MUCOSA Specialized membrane that lines the air distribution tubes in the respiratory tree (Figure 14-2) More than 125 mL of mucus produced each day forms a “ mucous blanket" over much of the respiratory mucosa Mucus serves as an air purification mechanism by trapping inspired irritants such as dust and pollen Cilia on mucosal cells beat in only one direction, moving mucus upward to pharynx for removal NOSE Structure Nasal septum separates interior of nose into two cavities Mucous membrane lines nose Frontal, maxillary, sphenoidal, and ethmoidal sinuses drain into nose (Figure 14-3) Functions W arms and moistens inhaled air Contains sense organs of smell PHARYNX Structure (Figure 14-4) Pharynx (throat) about 12. 5 cm (5 inches) long Divided into nasopharynx, oropharynx, and laryngopharynx Two nasal cavities, mouth, esophagus, larynx, and auditory tubes all have openings into pharynx PDF Created with deskPDF PDF Writer - Trial :: http://www. docudesk. com Pharyngeal tonsils and openings of auditory tubes open into nasopharynx; tonsils found in oropharynx Mucous membrane lines pharynx Functions Passageway for food and liquids Air distribution; passageway for air LARYNX Structure (Figure 14-5) Several pieces of cartilage form framework - Thyroid cartilage (Adam’s apple) is largest - Epiglottis partially covers opening into larynx Mucous lining Vocal cords

stretch across interior of larynx Functions Air distribution; passageway for air to move to and from lungs Voice production TRACHEA Structure (Figure 14-6) Tube about 11 cm (4. 5 inches) long that extends from larynx into the thoracic cavity Mucous lining C-shaped rings of cartilage hold trachea open Function–passageway for air to move to and from lungs Obstruction Blockage of trachea occludes the airway, and if blockage is complete, causes death in minutes Tracheal obstruction causes more than 4000 deaths annually in the United States BRONCHI, BRONCHIOLES, AND ALVEOLI Structure Trachea branches into right and left bronchi Each bronchus branches into smaller and smaller tubes eventually leading to bronchioles Bronchioles end in clusters of microscopic alveolar sacs, the walls of which are made up of alveoli (Figure 14-7) Function PDF Created with deskPDF PDF Writer - Trial :: http://www. docudesk. com Bronchi and bronchioles–air distribution; passageway for air to move to and from alveoli Alveoli–exchange of gases between air and blood (Figure 14-8) LUNGS AND PLEURA Structure (Figure 14-9) Size–large enough to fill the chest cavity, except f or middle space occupied by heart and large blood vessels Apex–narrow upper part of each lung, under collarbone Base–broad lower part of each lung; rests on diaphragm Pleura–moist, smooth, slippery membrane that lines chest cavity and covers outer surf ace of lungs; reduces f riction between the lungs and chest wall during breathing (Figure 14-10) Function–breathing (pulmonary ventilation) RESPIRATION Mechanics of breathing (Figure 14-11) Pulmonary ventilation includes two phases called inspiration (movement of air into lungs) and expiration (movement of air out of lungs) Changes in size and shape of thorax cause changes in air pressure within that cavity and in the lungs Air pressure differences actually cause air to move into and out of

the lungs RESPIRATION Inspiration Active process–air moves into lungs Inspiratory muscles include diaphragm and external intercostals - Diaphragm flattens during inspiration–increases top-to-bottom length of thorax - External intercostals contraction elev ates the ribs– increases the size of the thorax from the f ront to the back and from side to side Increase in the size of the chest cavity reduces pressure within it; air then enters the lungs RESPIRATION Expiration Quiet expiration is ordinarily a passiv e process During expiration, thorax returns to its resting size and shape Elastic recoil of lung tissues aids in expiration Expiratory muscles used in f orcef ul expiration are internal intercostals and abdominal muscles - Internal intercostals– contraction depresses the rib cage and decreases the size of the thorax from the front to back - Contraction of abdominal muscles elevates the diaphragm, thus decreasing size of the thoracic cavity from the top to bottom Reduction in the size of the thoracic cavity increases its pressure and air leav es the lungs PDF Created with deskPDF PDF Writer - Trial :: http://www. docudesk. com RESPIRATION Exchange of gases in lungs (Figure 14-12) Carbaminohem oglobin breaks down into carbon dioxide and hem oglobin Carbon dioxide m oves out of lung capillary blood into alveolar air and out of body in expired air Oxygen m oves from alveoli into lung capillaries Hem oglobin combines with oxygen, producing oxyhemoglobin Exchange of gases in tissues Oxyhemoglobin breaks down into oxygen and hem oglobin Oxygen m oves out of tissue capillary blood into tissue cells Carbon dioxide m oves from tissue cells into tissue capillary blood Hem oglobin combines with carbon dioxide, forming carbaminohem oglobin BLOOD TRANSPORTATION OF GASES Transport of oxygen Transport of carbon dioxide Volumes of air exc hanged in pulmonar y ventilation (Figur e

14- 13) Volumes of air exc hanged in br eathing c an be measur ed with a spir ometer Tidal volume (TV)– amount nor mally br eathed in or out with each br eath Vital c apacity (VC)– gr eatest amount of air that one c an br eathe out in one expir ation Expir ator y r es er ve volume ( ERV)– amount of air that c an be f orcibly exhaled after expir ing the tidal volume Inspir ator y r es er ve volume (IR V)– amount of air that c an be f orcibly inhaled after a nor mal inspir ation R esidual volume (RV)– air that r emains in the lungs after the most f orceful expir ation R ate–usually about 12 to 18 br eaths a minute; much faster dur ing exercis e REGULATION OF RESPIRATION (Figure 14-14) Regulation of respiration permits the body to adjust to varying dem ands for oxygen supply and carbon dioxide rem oval Most important c entr al r egulator y c enters in medulla ar e c alled r espir atory c ontr ol centers ( inspir ator y and expir ator y c enters) Under r es ting c onditions, ner vous activity in the r espir ator y c ontr ol c enters pr oduc es a normal r ate and depth of r espir ations (12 to 18 per minute) Respiratory control centers in the m edulla are influenced by “ inputs" from receptors located in other body areas: C er ebr al c or tex– voluntar y (but limited) c ontr ol of r espir ator y activity R ec eptors that influenc e r es pir ation - Chemoreceptors respond to changes in carbon dioxide, oxygen, and blood acid levels–located in carotid and aortic bodies - Pulmonary stretch receptors–respond to the stretch in lungs, thus protecting r espiratory organs from overinflation TYPES OF BREATHING Eupnea–normal breathing Hyperventilation–rapid and deep respirations Hypoventilation–slow and shallow respirations Dyspnea–labored or difficult respirations Apnea–stopped respiration Respiratory arrest–failure to resume breathing after a period of apnea PDF Created with deskPDF PDF Writer - Trial :: http://www. docudesk. com