Unit 6 Outline: The Lymphatic and Respiratory Systems

Lymphatic Vessels, Tissue, and Organs
- The Lymphatic System
  - Consists of _______ semi-independent parts
    - Lymphatic
    - Lymphoid tissues and _______
  - Lymphatic system functions
    - Transport fluids back to the _______
    - Play essential roles in body _______ and resistance to disease
- Lymphatic Characteristics
  - _______ - excess tissue fluid carried by lymphatic vessels
  - Properties of lymphatic vessels
    - _______ system toward the heart
    - No _______
    - Lymph moves toward the _______
      - Milking action of _______ muscle
      - Rhythmic contraction of _______ muscle in vessel walls
- Lymphatic Vessels
  - Lymph
    - Walls overlap to form flap-like _______
    - Fluid _______ into lymph capillaries
    - Capillaries are anchored to _______ tissue by filaments
    - Higher pressure on the _______ closes minivalves
  - Lymphatic _______ vessels
    - Collects lymph from lymph
    - Carries lymph to and away from lymph _______

- Returns fluid to circulatory _______ near the heart
  - _______ lymphatic duct
  - _______ duct

- Lymph
  - Materials _______ to the blood
    - _______
    - _______
  - Harmful materials that enter lymph vessels
    - _______
    - _______
    - _______ cells
    - Cell _______
  - Filter lymph before it is returned to blood
    - _______ cells within lymph nodes
    - _______ - engulf and destroy foreign substances
    - _______ - provide immune response to antigens
♦ Lymph Node Structure
- Most are ___________________ -shaped, less than 1 inch long
- ________________________________
  - ________________________________ part
  - Contains ___________________ - collections of lymphocytes
- ________________________________
  - Inner part
  - Contains phagocytic ___________

♦ Flow of Lymph Through Nodes
- Lymph enters the ________________ side through afferent lymphatic vessels
- Lymph flows through a number of ________________ inside the node
- Lymph exits through ________________ lymphatic vessels
- Fewer efferent than afferent vessels causes flow to be ________________

♦ Other Lymphoid Organs
- Several other organs contribute to lymphatic function
  - ________________________________
  - ________________________________
  - ________________________________

♦ The Spleen
- Located on the ________________ side of the abdomen
- Filters ________________________________
  - Destroys worn out blood __________________
  - Acts as a blood __________________
  - Forms blood cells in the __________________

♦ The Thymus
- Located low in the ________________, above the heart
- Functions at peak levels only during __________________
- Produces __________________ (like thymosin) to program lymphocytes

♦ Tonsils
- Small masses of lymphoid tissue around the __________________
- Trap and remove __________________ and other foreign materials
- __________________ is caused by congestion with bacteria

♦ Peyer’s Patches
- Found in the wall of the ________________ intestine
- Resemble __________________ in structure
- Capture and destroy bacteria in the ________________
Body Defenses

♦ Body Defenses
- The body is constantly in contact with bacteria, fungi, and ____________
- Two defense systems for foreign materials
  - ____________________________ defense system
    * Mechanisms protect against a variety of invaders
    * Responds ____________________________ to protect body from foreign materials
  - ____________________________ defense system
    * Specific defense is required for ____________________________ of invader
    * Also known as the ____________________________ system

♦ Nonspecific Body Defenses
- Body surface coverings
  - Intact ____________________________ membranes
- Specialized human ____________________________ produced by the body
- Surface Membranes- 1st Line of Defense
  - Physical barrier to foreign materials
  - pH of the skin is ____________________________ to inhibit bacterial growth
    * ____________________________ is toxic to bacteria
    * ____________________________ secretions are very acidic
  - ____________________________ mucosa
    - Secretes ____________________________ acid
    - Has protein-digesting ____________________________
  - ____________________________ and lacrimal fluid contain lysozyme
  - ____________________________ traps microorganisms in digestive and respiratory pathways

♦ Defensive Cells
- ____________________________ (neutrophils and macrophages)
  - Engulfs foreign material into a ____________________________
  - Enzymes from ____________________________ digest the material
- ____________________________ cells
  - Can lyse and kill ____________________________ cells
  - Can destroy ____________________________-infected cells

Inflammatory Response and Fever

♦ Inflammatory Response- 2nd Line of Defense
- Triggered when body tissues are ____________________________
- Produces ____________________________ cardinal signs
  - ____________________________
  - ____________________________
  - ____________________________
  - ____________________________
- Results in a chain of events leading to protection and ____________________________
- Functions of the Inflammatory Response
• Prevents spread of ____________________ agents
• Disposes of cell debris and ____________________
• Sets the stage for ____________________

**Antimicrobial Chemicals**
•________________________
  ▪ Group of at least ____________ plasma proteins
  ▪ Activated when they encounter and attach to cells (complement fixation)

•________________________
  ▪ Secreted ________________ of virus-infected cells
  ▪ Bind to healthy cell surfaces to ________________ viruses binding

**Fever**
• Abnormally high body ____________________

**Immune System: Third Line of Defense**

♦ The Immune System- 3rd Line of Defense
  • ________________ specific- recognizes and acts against particular foreign substances
  • ________________ - not restricted to initial infection site
  • Has ________________ - recognizes and mounts a stronger attack on previously encountered pathogens

♦ Types of Immunity
  • ________________ immunity
    ▪ Antibody-mediated immunity
    ▪ Cells produce ________________ for defense
  • ________________ immunity
    ▪ Cell- ________________ immunity
    ▪ Cells target ________________-infected cells

♦ Antigens (Nonself)
  • Substance that excites the ________________ system, provoking an immune response
  • Common ________________
    ▪ Foreign ________________
    ▪ ________________ acids
    ▪ Large ________________
    ▪ Some ________________
    ▪ ________________ grains
    ▪ Microorganisms

♦ Self-Antigens
  • Human cells have many surface ________________
  • Immune cells do not attack our own proteins
  • Our cells in another person’s body can trigger an immune response because they are ________________
    ▪ Restricts ________________ for transplants

♦ Allergies
  • ________________ (incomplete antigens) are not antigenic, but link up with our own proteins
  • Immune system may recognize and respond to a protein-hapten combination
• Immune response is ___________________ (it attacks our own cells)

♦ Cells of the Immune System

• ________________________
  - Originate from hemocytoblasts in the ______ bone marrow
  - ______ lymphocytes become immunocompetent in the bone marrow
  - ______ lymphocytes become immunocompetent in the thymus

• Arise from monocytes
  - Become widely distributed in ______________ organs

♦ Humoral Immune Response

• ________________________-Mediated
  - B lymphocytes with specific ____________________ bind to a specific antigen
  - Binding event activates the lymphocyte to undergo _______________ selection
  - Large number of clones are produced (primary humoral response)
  - Most B cells become ________________ cells
    - Produce ____________________ to destroy antigens
    - Activity lasts for ________________ days
  - Some B cells become long-lived cells (secondary humoral response)

♦ Secondary Response

• Memory cells are ______________________
  - Causes a __________________________ response
  - Is ___________________________ and longer lasting

♦ __________________________ Immunity
  - B cells encounter _______________ and produce antibodies
  - Can be naturally or _______________ acquired

♦ __________________________ Immunity
  - Antibodies are obtained from _______________
    - Passed naturally from a mother to _______________
    - Passed artificially from immune serum or gamma globulin
  - Immunological memory _________________ occur
  - Protection provided by “__________________ antibodies”
Antibodies

- Antibodies
  - Prepared for clinical testing or services
  - Produced from a single cell line
  - Examples of uses
    - Diagnosis of
    - Treatment for exposure to and rabies
- Antibodies (Immunoglobulins) (Igs)
  - Soluble secreted by B cells (plasma cells)
  - Carried in blood
  - Capable of binding specifically to an

Antibody Structure

- ________________ amino acid chains linked by disulfide bonds
- ________________ chains- 2 identical amino acid chains
- ________________ chains- 2 identical chains
- Specific ________________-binding sites are present

Antibody Classes

- Each class has slightly different major immunoglobulin classes
  - IgM- can fix complement
  - IgA- found mainly in

Antibody Function

- Inactivate antigens by:
  - ________________
  - ________________
  - ________________
  - ________________

Antibody Classes

- IgD- important in activation of ________________
- IgG- can cross the ________________ barrier
- IgE- involved in ________________

Cellular Immune Response

- Cell-
  - Antigens presented by macrophages to an immunocompetent ________________ (antigen presentation)
  - T cells must recognize and self (double recognition)
  - After antigen binding, clones form

T Cell Clones

- ________________ T cells
  - Specialize in killing ________________ cells
  - Insert a toxic chemical ________________
  - ________________ T cells
- Interact directly with _______________ T cells
- Release chemicals to suppress the activity of T and _______________ of allergen contact
- Stop the immune response to prevent uncontrolled activity
- A few members of each clone are _______________ cells

Transplants, Allergies, and Autoimmune Diseases

Organ Transplants and Rejection
- Major types of _______________
  - tissue transplanted from one site to another on the same person
  - tissue grafts from an identical twin
  - tissue taken from an unrelated person
  - tissue taken from a different animal species

Organ Transplants and Rejection
- Autografts and isografts are _______________ donors
- Xenografts are never successful
- Allografts are more successful with a closer tissue match

Abnormal, _______________ immune responses

Types of allergies
- _______________ hypersensitivity
  - Triggered by release of histamine from IgE binding to mast cells
  - Reactions begin within _______________ of allergen contact
  - shock-dangerous, systemic response
- _______________ hypersensitivity
  - Triggered by the release of lymphokines from activated helper T cells
  - Symptoms appear _______________ days after antigen contact

Immunodeficiencies
- Immune cell production/function or complement is _______________

- May be _______________ or acquired
- Includes _______________ - Acquired Immune Deficiency Syndrome

Autoimmune Diseases
- Immune system doesn’t distinguish between _____ and nonself
- Body produces _______________ and sensitized T lymphocytes that attack its own tissues

Examples of Autoimmune Diseases
- _______________ - white matter of brain and spinal cord are destroyed
- _______________ - impairs communication between nerves and skeletal muscles
• pancreatic beta cells that produce insulin - destroys
• ____________________ - destroys joints
• ____________________ - (SLE) affects kidney, heart, lung and skin
• ____________________ - impairment of renal function

♦ Self-Tolerance Breakdown
• Inefficient lymphocyte ____________________
• Appearance of self-proteins in the circulation that have not been exposed to the immune system
  • ____________________
  • ____________________
  • Eye ____________________
  • _______________ - reaction of antibodies produced against foreign antigens with self-antigens
  • ____________________ fever

♦ Developmental Aspects
• Lymphoid organs are _______________ developed before birth (Except thymus and spleen)
• Newborn has no functioning lymphocytes at birth; only _______________ immunity from the mother
• If lymphatics are removed or lost, severe _______________ results, but vessels grow back in time

Organ of the Respiratory system
♦ Organs of the Respiratory system
• _______________
  • Pharynx
  • _______________
  • _______________
  • _______________
  • _______________
• Lungs- _______________

♦ Function of the Respiratory System
• Oversees _______________ exchanges between the blood and external environment
• Takes place in the alveoli of the lungs
• Passageways to the lungs _______________. warm, and humidify the incoming air

♦ The Nose
• Only _______________ visible part of the respiratory system
• Air enters the nose through the external ___________ (nostrils)
• Interior of the nose consists of a nasal cavity divided by a nasal _______________

Anatomy of the Nasal Cavity
• Olfactory receptors are located in the _______________ on the superior surface
• Rest of the cavity is lined with respiratory mucosa
  • _______________ air
• Traps incoming _______________ particles
• ____________________ - projections of lateral walls

Diagram of the Respiratory System
Increases __________________area
Increases air __________________ within the nasal cavity
Nasal cavity is separated from the oral cavity by the palate
Anterior __________________ palate (bone)
Posterior __________________ palate (muscle)
Paranasal Sinuses
Cavities within bones around the nasal cavity
Anterior palate (bone)
Posterior palate (muscle)
Paranasal sinuses
Nasal cavity is separated from the oral cavity by the palate
Anterior ___________________________________ palate (bone)
Posterior ___________________________________ palate (muscle)
Function of the sinuses
________________________________________ the skull
Act as __________________ chambers for speech
Produce __________________ that drains into the nasal cavity
Pharynx (Throat)
Muscular passage from nasal cavity to larynx
Three regions of the pharynx
Superior region behind nasal cavity
Middle region behind mouth
Inferior region attached to larynx
Oropharynx and laryngopharynx are passageways for __________________ and __________________
Structures of the Pharynx
Tubes enter the nasopharynx
Nasopharynx of the pharynx
Pharyngeal tonsil __________________ in the nasopharynx
Tonsils in the oropharynx
Tonsils at the base of the tongue
Larynx (Voice Box)
Rigid hyaline cartilages and a spoon-shaped flap of elastic cartilage (epiglottis)
Routes __________________ and food into proper channels
Plays a role in __________________
Structures of the Larynx
cartilage
Largest __________________ cartilage
Protrudes anteriorly __________________ apple
Opening of the larynx
Routes food to the larynx and air toward the
Cords (vocal folds)
Vibrate with expelled air to create sound
Opening between vocal cords
Trachea, Bronchi, and Lungs
Trachea (Windpipe)
Connects larynx with __________________
Lined with __________________ mucosa
Beat continuously in the __________________ direction of incoming air
Expel mucus loaded with __________________ and other debris
Walls are reinforced with C-shaped ____________ cartilage
Primary Bronchi
Formed by division of the trachea
Enters the lung at the __________________ (medial depression)
Right bronchus is __________________, shorter, and straighter than left
Subdivide into smaller and smaller branches
Lungs
Occupy most of the __________________ cavity
Located near the clavicle (superior portion)
Located on the diaphragm (inferior portion)
Each lung is divided into ______________ by fissures
Left lung- ______________ lobes
Right lung- ______________ lobes
Unit 6 Outline: The Lymphatic and Respiratory Systems
Coverings of the Lungs
- Pulmonary (visceral) covers the lung surface
- Pleura lines the walls of the thoracic cavity
- Pleural fills the area between layers of pleura to allow gliding

Respiratory Tree Divisions
- Primary
- Secondary bronchi
- Bronchi
- Bronchioles
- Bronchioles are branches of the bronchi
- All but the smallest branches have cartilage
- Terminal bronchioles end in alveoli

Respiratory Zone
- Structures
  - Respiratory
  - Alveolar
  - Site of gas exchange

Alveoli
- Structure of alveoli
  - Alveolar
  - Alveolar
  - Alveolar
- Gas exchange takes place within the alveoli in the respiratory membrane

Respiratory Membrane (Air-Blood Barrier)
- Thin squamous layer lining alveolar walls
- Pulmonary covers external surfaces of alveoli

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Inspiration and Expiration
- Gas Exchange
  - Gas crosses the respiratory membrane by diffusion
  - Carbon dioxide enters the blood
  - Carbon dioxide enters the blood
  - Add protection
  - Coats gas-exposed alveolar surfaces

Events of Respiration
- Pulmonary - moving air in and out of the lungs
- Respiratory gas exchange between pulmonary blood and alveoli
- Respiratory gas transport of oxygen and carbon dioxide via the bloodstream
- Respiratory gas exchange between blood and tissue cells in systemic capillaries

Mechanics of Breathing (Pulmonary Ventilation)
- Completely Process
• Depends on ________________ changes in the thoracic cavity
• Volume changes lead to ________________ changes, which lead to the flow of gases to equalize pressure
• Two phases
  - ________________ - flow of air into lung
  - ________________ - air leaving lung

♦ Inspiration
• ________________ and intercostal muscles contract
• The size of the thoracic cavity ________________
• External air is pulled into the lungs due to an increase in ________________ volume

♦ Expiration
• Largely a ________________ process which depends on natural lung elasticity
• As muscles ________________, air is pushed out of the lungs
• ________________ expiration can occur mostly by contracting internal intercostal muscles to depress the rib cage

♦ Thoracic Cavity Pressure Differences
• Normal pressure within the pleural space is always ________________ (intrapleural pressure)
• Differences in lung and pleural space pressures keep lungs from ________________

♦ Respiratory Volumes and Capacities
• Normal breathing moves about ________________ ml of air with each breath (tidal volume [TV])
• Factors that affect respiratory capacity
  - A person’s ________________
  - ________________
  - ________________ condition
• Residual volume of air
  - Inspiratory reserve volume (______________)
  - Amount of air that can be taken in forcibly over the tidal volume
  - Usually between ________________ and ________________ ml
• Expiratory reserve volume (______________)
  - Amount of air that can be forcibly exhaled
  - Approximately ________________ ml
  - ________________ volume
• Air remaining in lung after ________________
  - About 1200 ml
• ________________ capacity
  - The total amount of ________________ air
  - Vital capacity = TV + IRV + ERV
  - ________________ space volume
    * Air that remains in ________________ zone and never reaches alveoli
    * About ________________ ml
  - ________________ volume
    * Air that actually reaches the respiratory zone
    * Usually about ________________ ml
• Respiratory capacities are measured with a

♦ Can be caused by ________________ or voluntary actions
• Examples
  - ________________ and sneezing clears lungs of debris
  - ________________
  - Crying
  - ________________

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Respiratory Sounds
- Sounds are monitored with
  - sounds - produced by air rushing through trachea and bronchi
  - sounds - soft sounds of air filling alveoli

External and Internal Respiration

External Respiration
- movement into the blood
  - Alveoli always has more than the blood
  - $O_2$ moves by capillary
    - blood gains $O_2$

movement out of the blood
- Blood returning from tissues has more $CO_2$ than air in the alveoli
  - Pulmonary capillary blood gives up __________
  - Blood leaving the lungs is oxygen-rich and carbon dioxide-poor

Gas Transport in the Blood
- Inside red blood cells attached to hemoglobin
  - Small amount in the plasma

Most transported in the plasma as ____________________ ion ($HCO_3^-$)
- Small amount is carried inside red blood cells on hemoglobin (different __________ than $O_2$)

Internal Respiration
- Gas exchange between blood and __________
- Opposite reactions to what occurs in the lungs
  - __________ diffuses out of tissue to blood
  - __________ diffuses from blood into tissue

Neural Regulation of Respiration
- Respiratory muscle activity is sent to the brain by the ________________ and intercostal nerves
  - ________________ - neural centers that control breathing rate and depth
• Smooths out respiratory rate
  ▪ Normal respiratory rate (___________)
    is 12-15 respirations per minute
  ▪ _______________ is increased respiratory rate often due to extra oxygen needs

♦ Factors Influencing Respiratory Rate and Depth
  • Physical factors
    ▪ Increased body _______________
    ▪ _______________
    ▪ _______________
    ▪ Coughing
    ▪ _______________ (conscious control)
  • _______________ factors
  • _______________ factors
    ▪ CO₂ levels
      * Levels in the blood are the main chemical factor
    ▪ _______________ CO₂ increases respiration
    ▪ O₂ levels
      * Changes in O₂ levels are detected by chemoreceptors in the _______________ and _______________ artery
    ▪ Information is sent to the _______________

**Homeostatic Imbalances of the Respiratory System**

♦ Chronic Obstructive Pulmonary Disease
  • _______________
  • Symptoms- chronic bronchitis
    and _______________
  • Major causes of death/disability in the U.S.
  • Features of these diseases
    ▪ Patients usually have a history of _______________
    ▪ Labored breathing (_______________) becomes worse
    ▪ _______________ and frequent pulmonary infections
    ▪ Most victims retain CO₂, are _______________ and have respiratory acidosis
    ▪ Ultimately leads to respiratory _______________

♦ Emphysema
  • Alveoli _______________ as adjacent chambers break through
  • Chronic inflammation promotes lung _______________
  • Airways _______________ during expiration
  • Large amount of _______________ used to exhale
  • Overinflation of the lungs leads to a permanently expanded _______________
  • _______________ appears late in the disease

♦ Chronic Bronchitis
  • Mucosa of the lower respiratory passages becomes severely _______________
  • _______________ production increases
  • Pooled mucus impairs _______________ and gas exchange
  • Risk of lung infection increases
  • _______________ is common
  • _______________ and cyanosis occur early

♦ Lung Cancer
  • 1/3 of all cancer deaths in the U.S.
  • Increased incidence with smoking
  • _______________ common types
    ▪ _______________ carcinoma
    ▪ _______________ carcinoma
    ▪ _______________ carcinoma

♦ Sudden Infant Death syndrome (_______________)
• Apparently ___________ infant stops breathing and dies during sleep
• Thought to be a ________________ problem of the respiratory control center
• ________________ of cases appear to be due to heart rhythm abnormalities

◆ Asthma
• Chronic inflamed hypersensitive ________________ passages
• ________________, coughing, and wheezing

◆ Developmental Aspects of the Respiratory System
• Lungs are filled with ________________ in the fetus
• Lungs don’t fully inflate with air until __________ weeks after birth
• ________________ is not present until late in fetal development (may not be present in premature babies)
• Important birth defects
  • ________________- over secretion of thick mucus clogs the respiratory system
  • ________________ palate

◆ Aging Effects
• ________________ of lungs decreases
• ________________ decreases
• ________________ levels decrease
• Stimulating effects of ____________ decreases
• More risks of respiratory tract infection

◆ Respiratory Rate Changes Throughout Life
• Newborns- ________ to 80 respirations per minute
• Infants- ______________ respirations per minute
• Age 5- ______________ respirations per minute
• Adults- 12 to __________ respirations per minute
• Rate often increases somewhat with old age