Objectives

1. Define key terms introduced in this chapter.
2. Explain the importance of knowledge of anatomy and physiology to patient assessment and care (slides 28-39).
3. Define the terms anatomy and physiology (slides 28-29).
Objectives

4. Describe each of the following terms of position (slides 30-34):
   a. Anatomical position
   b. Supine
   c. Prone
   d. Lateral recumbent
   e. Fowler position
   f. Semi-Fowler position
   g. Trendelenburg position
   h. Shock position
Objectives

5. Identify each of the following anatomical terms (slides 35-37):
   a. Midline
   b. Sagittal plane
   c. Frontal plane
   d. Transverse plane
   e. Midaxillary line
   f. Midclavicular line
   g. Anterior and posterior
   h. Dorsal and ventral
Objectives

5. Identify each of the following anatomical terms (slides 35-37):
   i. Right and left
   j. Superior and inferior
   k. Medial and lateral
   l. Proximal and distal
   m. Plantar
   n. Palmar
   o. Abdominal quadrants: right upper quadrant, left upper quadrant, left lower quadrant, right lower quadrant
Objectives

6. State the function of each of the following musculoskeletal system structures (slide 40):
   a. Skeletal muscle
   b. Tendons
   c. Ligaments
   d. Bone

7. Describe each of the following components of the skeleton, including its location, the bones that make it up, and its function (slides 41-47):
   a. Skull
      i. Cranium
      ii. Face
7. Describe each of the following components of the skeleton, including its location, the bones that make it up, and its function (slides 41-47):

b. Spinal column
   i. Cervical spine
   ii. Thoracic spine
   iii. Lumbar spine
   iv. Sacral spine
   v. Coccyx

c. Thorax
   i. Sternum (including manubrium, body, and xiphoid process)
   ii. Ribs
7. Describe each of the following components of the skeleton, including its location, the bones that make it up, and its function (slides 41-47):

d. Pelvis
   i. Ilium and iliac crest
   ii. Ischium
   iii. Pubis
   iv. Acetabulum
7. Describe each of the following components of the skeleton, including its location, the bones that make it up, and its function (slides 41-47):
e. Upper extremities
   i. Clavicle
   ii. Scapula, including acromion process
   iii. Humerus
   iv. Radius
   v. Ulna, including olecranon process
   vi. Carpals
   vii. Metacarpals
   viii. Phalanges
Objectives

7. Describe each of the following components of the skeleton, including its location, the bones that make it up, and its function (slides 41-47):
   
   f. Lower extremities
      
      i. Femur
      ii. Patella
      iii. Tibia, including medial malleolus
      iv. Fibula, including lateral malleolus
      v. Tarsals, including the calcaneus
      vi. Metatarsals
      vii. Phalanges
Objectives

8. Demonstrate each of the following joint movements (slide 48):
   a. Flexion and extension
   b. Adduction and abduction
   c. Circumduction
   d. Pronation and supination

9. Describe each of the following types of joints (slide 49):
   a. Ball-and-socket
   b. Hinge
   c. Pivot
   d. Gliding
   e. Saddle
   f. Condyloid
Objectives

10. Differentiate between skeletal (voluntary), smooth (involuntary), and cardiac muscle (slide 55).
11. Identify the basic functions of the respiratory system (slide 56).
12. Identify the following structures of the respiratory system (slides 57-58):
   a. Upper airway: nose, mouth, pharynx, nasopharynx, larynx
   b. Lower airway: trachea, bronchi, bronchioles, alveoli
   c. Epiglottis
   d. Lungs
   e. Pleura
   f. Diaphragm
Objectives

13. Identify important differences in respiratory system anatomy in children (slides 59-60).

14. Describe the basic mechanics and physiology of normal ventilation, respiration, and oxygenation, including (slides 61-65):
   a. Inhalation and exhalation
   b. Use of intercostal muscles and diaphragm
   c. Negative and positive pressure
   d. Nervous system control of respiration
   e. Alveolar/capillary exchange of oxygen and carbon dioxide
   f. Capillary/cell exchange of oxygen and carbon dioxide
Objectives

15. Identify characteristics of both adequate and inadequate breathing (slides 66-67).

16. List the functions of the circulatory (cardiovascular) system (slides 68-69).

17. Describe the anatomy and physiology of the heart to include (slides 70-72):
   a. Location and size
   b. Tissue layers
   c. Chambers
   d. Valves
   e. Blood supply
   f. Blood flow through the heart
   g. Conduction system
Objectives

18. Discuss the anatomy and physiology of the blood, circulation, perfusion, and metabolism to convey basic comprehension of (slides 73-83):
   a. Arteries and arterioles
   b. Capillaries
   c. Veins and venules
   d. Blood composition
   e. Perfusion and capillary exchange
   f. Cell metabolism

19. Describe the basic functions of the nervous system (slide 84).

20. Differentiate between the structural components and basic functions of the central nervous system and peripheral nervous system (slides 84-86).
21. Differentiate between the functional divisions of the peripheral nervous system (slide 87):
   a. Voluntary (somatic) nervous system
   b. Involuntary (autonomic) nervous system
      i. Sympathetic division
      ii. Parasympathetic division

22. Describe the basic role of the reticular activating system (RAS) and cerebral hemispheres in consciousness and unconsciousness (slides 88-89).

23. Explain the overall function of the endocrine system (slide 90).
Objectives

24. Discuss the location and general function of each of the following components of the endocrine system (slides 92-93):
   a. Thyroid gland
   b. Parathyroid glands
   c. Adrenal glands
   d. Gonads
   e. Islets of Langerhans of the pancreas, insulin, and glucagon
   f. Pituitary gland

25. Describe the general actions of epinephrine and norepinephrine on beta_1, beta_2, alpha_1, and alpha_2 receptors of the sympathetic nervous system (slide 94).
26. List the general functions of the integumentary system (slide 95).

27. Identify the structures of the integumentary system, including the epidermis, dermis, and subcutaneous layer (slide 96).

28. Describe the basic anatomy and physiology of each of the following structures of the digestive system (slides 97-98)
   a. Stomach
   b. Pancreas
   c. Liver
   d. Gallbladder
   e. Small intestine (duodenum, jejunum, ileum)
   f. Colon
Objectives

29. List the basic structure and function of the organs of the urinary or renal system to include (slides 99-100):
   a. Kidneys
   b. Ureters
   c. Urinary bladder
   d. Urethra
30. State the basic structure and function of the organs of the male and female reproductive systems (slides 101-102):

a. Male
   i. Testes
   ii. Accessory glands
   iii. Penis

b. Female
   i. Ovaries
   ii. Fallopian tubes
   iii. Uterus
   iv. Vagina
   v. External genitalia
Objectives

31. Explain the importance of knowledge of medical terminology in communication among health care team members (slide 103).

32. Apply knowledge of common prefixes, suffixes, and roots to interpret medical terms (slides 104-107).
Multimedia Directory

Slide 50  Skeletal System Labeling Exercise
Slide 74  Heart and Major Vessels Animation
Slide 93  Endocrine System Components Animation
Topics

- Anatomical Terms
- Body Systems
- Medical Terminology
CASE STUDY

Dispatch
EMS Unit 108

Respond to Centennial Park on Highland Avenue—you have a female patient at that location who suffered a burn.

Time out 1306
Upon Arrival

• You position the ambulance out of the flow of traffic
• A bystander runs up and says, “A woman was trying to refuel her son’s model airplane and it blew up!”
• The patient is sitting on a patch of grass about 15 feet away from a smoldering model airplane
How would you proceed to assess and care for this patient?
Anatomical Terms
Anatomy versus Physiology

How the body is made

How the body works

Back to Objectives
Anatomical Position

• Standing erect
• Facing forward
• Arms at sides
• Palms forward
Trendelenburg’s Position

Shock Position

No longer recommended for shock
Chest Landmarks

- Anterior axillary line
- Midclavicular line
- Midline
- Suprasternal notch
- Manubrium
- Angle of Louis
- Sternum
- Costal margin
- Xiphoid process
- Posterior axillary line
- Midaxillary line
- Anterior axillary line
Body Systems
The Musculoskeletal System

The Skeletal System

Back to Objectives
The Skull

- Cranium
- Frontal bone
- Orbit
- Parietal bone
- Temporal bone
- Zygomatic bone
- Mastoid process
- Maxilla
- Mandible
- Teeth
- Facial bones
- Nasal bone
The Spinal Column

Back to Objectives
The Thorax

- Cervical vertebra (neck)
- Sternum
- Xiphoid process
- Clavicle
- Scapula (shoulder blade)
- Ribs
- Humerus
- Elbow
The Pelvis

Iliac crest
Ilium (hip)
Pelvic girdle
Greater trochanter
Symphysis pubis

Ulna
Radius
Sacrum
Coccyx
Carpals (wrist)
Metacarpals (hand)

Back to Objectives
Lower Extremities

- Pelvic girdle
- Greater trochanter
- Symphysis pubis
- Coccyx
- Carpals (wrist)
- Metacarpals (hand)
- Phalanges (fingers)
- Femur
- Patella (knee cap)
- Tibia
- Fibula
- Tarsals (ankle)
- Metatarsals (foot)
- Phalanges (toes)
- Calcaneus (heel)
Upper Extremities
Skeletal System Labeling

Click here to view an exercise on skeletal system labeling.

Return to Directory
The Musculoskeletal System

Bone Injury
• Large blood supply
• Severe bleeding
• May produce shock
The Muscular System

- Frontalis
- Temporalis
- Orbicularis Oculi
- Masseter
- Orbicularis Oris
- Sternocleidomastoid
- Trapezius
- Deltoid
- Pectoralis
- Triceps
- Serratus Anterior
- Biceps
- Latissimus Dorsi
- Rectus Abdominis
- Exterior Oblique
- Sartorius
- Gluteus Maximus
- Rectus Femoris
- Vastus Lateralis
- Vastus Medialis
- Gastrocnemius

How a Muscle Attaches to a Bone

- Muscle Body Fibers
- Periosteum
- Bone
- Tendon
**Skeletal Muscle**
- Voluntary
- Movement
- Protection

**Cardiac Muscle**
- Specialized
- Automaticity
- Intolerant of blood loss

**Smooth Muscle**
- Involuntary
- Nonstriated
- Found in blood vessels
The Respiratory System

Basic Anatomy

Back to Objectives
Respiratory Anatomy
Lower Airway

- Thoracic wall
- Trachea
- Parietal pleura
- Visceral pleura
- Bronchus
- Lungs
- Mediastinum
- Diaphragm
Child has smaller nose and mouth.

In child, more space is taken up by tongue.

Child’s trachea is narrower.

Cricoid cartilage is less rigid and less developed.

Airway structures are more easily obstructed.

**Pediatric Differences**
The Respiratory System

Mechanics of Ventilation

Back to Objectives
Ventilation

A. Inspiration

- Intercostal muscles contract and pull ribs up and outward.
- Lung expands
- Diaphragm contracts and moves down and outward.

B. Expiration

- Intercostal muscles relax and ribs go back to normal position.
- Lung recoils
- Diaphragm relaxes and moves upward.
The Respiratory System

Physiology of Respiration
Alveolar Respiration

Blood from the right side of the heart enters the pulmonary capillary.

Deoxygenated blood has low levels of \( O_2 \) and high levels of \( CO_2 \).

Capillary

Red blood cells

Oxygenated blood has high levels of \( O_2 \) and low levels of \( CO_2 \).

Alveolus

Blood leaves the capillary and is transported back to the left side of the heart.
Cellular Respiration
The Respiratory System

Adequate and Inadequate Breathing
Fast or slow respiratory rate
Retractions
Cyanosis
Shallow breaths
Use of accessory muscles
Cool, clammy skin
Irregular rhythm
Increased effort to breathe
Nasal flaring
Tripod position
Inadequate Breathing
The Circulatory System

Basic Anatomy
Perfusion
Conduction

- Superior vena cava
- Aorta
- Sinoatrial node (pacemaker)
- Left atrium
- Right atrium
- Atrioventricle node
- Left ventricle
- Right ventricle
- Purkinje fibers
- Inferior vena cava
- Right and left branches of the bundle of His
Click here to view an animation of the heart and major vessels.

Return to Directory
The Circulatory System

Composition of the Blood
• Red blood cells transport oxygen

• White blood cells are part of your immune system

• Platelets and other clotting factors cause clotting

• Plasma is the liquid part of blood
The Circulatory System

Physiology of Circulation
Perfusion: The delivery of oxygen, glucose, and nutrients to tissue, and the elimination of waste.
The Circulatory System

Transport of Gases in the Blood
O₂

3% dissolved in plasma

97% attached to hemoglobin
7% dissolved in plasma

23% attached to hemoglobin

70% converted to bicarbonate
The Circulatory System

Cell Metabolism
Aerobic Metabolism

Anaerobic Metabolism

Cell

O₂

CO₂

Acid
The Nervous System

Structural Divisions of the Nervous System
Central nervous system

Peripheral nervous system
The Nervous System

Functional Divisions of the Nervous System
Voluntary Nervous System

Autonomic Nervous System

- Sympathetic
- Parasympathetic
The Nervous System

Consciousness and Unconsciousness

Back to Objectives
Conscious Reticular activating system

Hemispheres:
Left
Right

Unconscious
The Endocrine System
Endocrine System

- Pituitary
- Hypothalamus
- Thyroid
- Parathyroids (located behind the thyroid)
- Thymus
- Adrenals
- Pancreas
- Ovaries (female)
- Testes (male)
The Endocrine System

Epinephrine and Norepinephrine
Endocrine System Components

Click here to view an animation of the endocrine system components.

Return to Directory
**Alpha 1**
Constricts blood vessels

**Alpha 2**
Regulates Alpha 1 effects

**Beta 1**
Increases heart rate, force, and automaticity

**Beta 2**
Dilates smooth muscle
The Integumentary System (Skin)
Integumentary System

THE SKIN

Hair shaft

Epidermis

Nerve fibers

Arrector pili muscle

Dermis

Sweat pore

Sebaceous (oil) gland

Nerve ending

Hair root

Bulb

Papilla

Vein

Subcutaneous fatty tissue

Artery

Deep fascia

Sweat gland

Fatty lobule

Muscle

Back to Objectives
The Digestive System
The Urinary or Renal System
The Reproductive System
Medical Terminology
Medical Words and Word Parts
Combining Forms

root slash combining vowel hyphen

cardi / o -

cardi/o/o-
Prefix

a-  nulli-
allo- para-
brady- peri-
hetero- poly-
macro- supra-
micro- tachy-
Follow-Up
Upon Arrival

You position the ambulance out of the flow of traffic. A woman runs up to you and says, “A woman over here was trying to refuel her son’s model airplane when the gas tank blew up or something.” Your patient is sitting on a patch of grass about 15 feet away from a smoldering model plane.
Critical Thinking Scenario

- 23-year-old male with multiple stab wounds to the neck, right front chest, and abdomen
- He is screaming in pain

**Vital signs:**
- BP: 88/68 mmHg
- Radial pulse is weak and rapid
- RR: 28 per minute
- Skin is pale, cool, and clammy
1. What body systems do you suspect could be injured by the knife wounds?
2. Using medical terminology and anatomical terms, give hypothetical examples of how to describe the wounds to the neck, chest and abdomen in a written EMS report.
3. What is causing the elevated heart rate?
4. What is causing the skin to be pale, cool, and clammy?
5. What is the significance of the systolic and diastolic blood pressure? How does it relate to pulse pressure?
Reinforce and Review

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