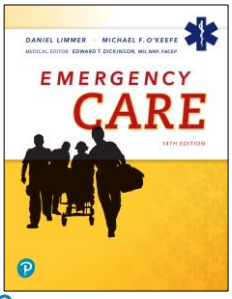
Emergency Care

Fourteenth Edition



Chapter 6

Anatomy and Physiology

Topics

Locating Body Organs and Structures

Back to Topics

Locating Body Organs and Structures

- Visualizing
- Topography

Body Systems

Back to Topics

Musculoskeletal System (1 of 12)

- Three main functions
  - Gives the body shape
  - Protects vital internal organs
  - Provides for body movement

Musculoskeletal System (2 of 12)

- Skeleton
  - Consists of skull and spine, ribs and sternum, shoulders and upper extremities, and pelvis and lower extremities

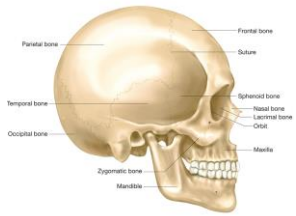
Musculoskeletal System (3 of 12)

- Skull
  - Bony structure of the head
  - Function to enclose, protect brain
  - Cranium
    - Top, back, and sides
  - Face
    - Front of the skull

Musculoskeletal System (4 of 12)

- Cranium connects to facial bones
  - Mandible
  - Maxillae
  - Nasal bones
  - Orbits
  - Zygomatic arches

Skull



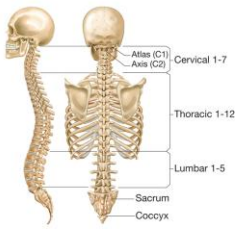
For long description, see slide 76: Appendix 1

The skull consists of the cranium and face.

Musculoskeletal System (5 of 12)

- Spinal column
  - 33 vertebrae that encase the spinal cord
  - Spinal cord is essential for movement, sensation, and vital functions
- Thorax
  - 12 ribs and sternum
  - Protects the heart, lungs, and major blood vessels

Spinal Column



For long description, see slide 77: Appendix 2

The divisions of the spine.

Musculoskeletal System (6 of 12)

- Pelvis
  - Ilium
  - Ischium
  - Pubis
  - Hip joint
    - Acetabulum
    - Ball at proximal end of femur

Musculoskeletal System (7 of 12)

- Lower extremities
  - Femur
  - Patella
  - Tibia
  - Fibula
  - Ankle
    - Lateral malleolus
    - Medial malleolus
    - Tarsals

Musculoskeletal System (8 of 12)

- Foot
  - Metatarsals
  - Calcaneus
    - Heel
  - Phalanges
    - Toe bones

Musculoskeletal System (9 of 12)

- Upper extremities
  - Clavicle
  - Scapula
  - Acromion process
    - Acromioclavicular joint
  - Humerus
  - Radius
  - Ulna

Musculoskeletal System (10 of 12)

- Wrist
  - Carpals
- Hand
  - Metacarpals
  - Phalanges are finger bones.

Skeletal System

For long description, see slide 78: Appendix 3

The skeleton.

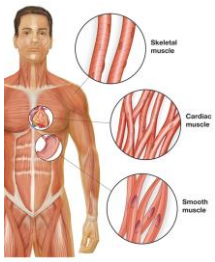
Musculoskeletal System (11 of 12)

- Joints
  - Formed when bones connect to other bones
  - Two types of joints
    - Ball-and-socket
    - Hinge

Musculoskeletal System (12 of 12)

- Muscles
  - Voluntary (skeletal)
  - Involuntary (smooth)
  - Cardiac
    - Automaticity
      - Heart has ability to generate and conduct own electrical impulses

Muscle



Three types of muscle.

Respiratory System (1 of 2)

- Brings in oxygen via inhalation
- Excretes carbon dioxide via exhalation

Respiratory Anatomy (1 of 2)

- Air enters body through the mouth and nose.
- It moves through the oropharynx and the nasopharynx.
  - The pharynx includes both areas.
- Air moves toward the lungs.
- Epiglottis
  - Closes over glottis

Respiratory Anatomy (2 of 2)

- Larynx
  - Voice box containing vocal cords
  - Cricoid cartilage forms lower portion
- Trachea
- Lungs
  - Bronchi
  - Alveoli
- Diaphragm

Respiratory System (2 of 2)

For long description, see slide 79: Appendix 4

The respiratory system.

Respiratory Physiology (1 of 5)

- Inhalation (active process)
  - Diaphragm and intercostal muscles contract; diaphragm moves downward and ribs move upward and outward.
  - Negative pressure pulls air into lungs.

Respiratory Physiology (2 of 5)

- Exhalation (passive process)
  - Diaphragm and intercostal muscles relax.
  - Positive pressure pushes air out of lungs.

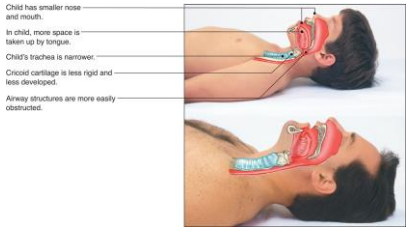
Respiratory Physiology (3 of 5)

- Ventilation
  - Movement of gases to and from alveoli
- Respiration
  - Exchange of gases between cells and bloodstream

Respiratory Physiology (4 of 5)

- Oxygenated blood is carried from the lungs to heart, then is pumped to rest of the body.
- At the cellular level, oxygen (O_2) is exchanged with cells for waste carbon dioxide (CO_2)
- Deoxygenated blood returns to the heart, then to lungs to exchange waste CO_2 for O_2

Respiratory Physiology (5 of 5)



For long description, see slide 80: Appendix 5

Comparison of child and adult respiratory anatomies.

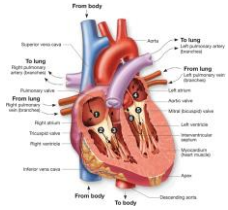
Cardiovascular System

- Heart
- Blood
- Blood vessels

Anatomy of the Heart (1 of 2)

- Four chambers
  - Two atria (upper areas)
  - Two ventricles (lower areas)
- Pathway of blood through heart
  - Right atrium
  - Right ventricle
  - Left atrium
  - Left ventricle

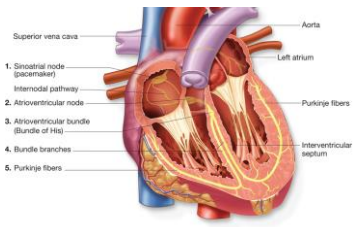
Anatomy of the Heart (2 of 2)



For long description, see slide 81: Appendix 6

The path of blood flow through the heart.

Cardiac Conduction System



For long description, see slide 82: Appendix 7

The cardiac conduction system.

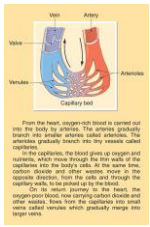
Circulation of the Blood (1 of 3)

- Important arteries to know:
  - Coronary arteries
  - Aorta
  - Pulmonary artery
  - Carotid artery
  - Femoral artery

Circulation of the Blood (2 of 3)

- Brachial artery
- Radial artery
- Posterior tibial artery
- Dorsalis pedis artery

Circulation of the Blood (3 of 3)



For long description, see slide 83: Appendix 8

Arteries, capillaries, and veins.

Composition of the Blood

- Plasma
  - More than half the volume of the blood
- Red blood cells
  - RBCs, erythrocytes, red corpuscles
- White blood cells
  - WBCs, leukocytes, white corpuscles
- Platelets
  - Help with clotting

Pulse (1 of 3)

- Pressure wave of blood flowing down an artery when the left ventricle contracts
- Can be felt by compressing an artery over a bone

Pulse (2 of 3)

- Peripheral (outer parts of body) pulse
  - Radial
  - Brachial
  - Posterior tibial
  - Dorsalis pedis
- Central (core of body) pulse
  - Carotid
  - Femoral

Pulse (3 of 3)

- Pulses near the center part of the body
- Carotid and femoral pulses can be felt even when peripheral pulses are too weak to be felt.

Blood Pressure

- Force blood exerts against the walls of blood vessels
- Systolic (upper reading)
  - Arterial pressure when left ventricle contracts
- Diastolic (lower reading)
  - Pressure when left ventricle refills

Perfusion

- Adequate supply of oxygen and nutrients to the cells of the body, with the removal of waste products
- Hypoperfusion (shock)
  - When perfusion becomes inadequate

Think About It

- How is the function of the respiratory system related to the function of the circulatory system?

Life Support Chain

- Interaction of respiratory system and cardiovascular system is the cardiopulmonary system
- Perfusion
  - Cells oxygenated
  - Carbon dioxide removed

Lymphatic System (1 of 3)

- Functions
  - Capture fluid
  - Maintain balance of fluid

Lymphatic System (2 of 3)

- Lymphoid organs
  - Adenoids
  - Tonsils
  - Spleen
  - Thymus
  - Nodes

Lymphatic System (3 of 3)

- Avoid taking blood pressure on the side of a woman's body where a mastectomy has been performed.

Nervous System (1 of 2)

The nervous system.

Nervous System (2 of 2)

- Central nervous system
  - Brain
  - Spinal cord
- Peripheral nervous system
  - Sensory nerves
  - Motor nerves
- Autonomic nervous system
  - Involuntary motor functions

Digestive System (1 of 2)

- Provides the mechanisms by which food travels through the body and is digested
- Consists of:
  - Stomach
  - Small intestine
  - Large intestine

Digestive System (2 of 2)

- Accessory organs
  - Liver
  - Gallbladder
  - Pancreas
  - Spleen
  - Appendix

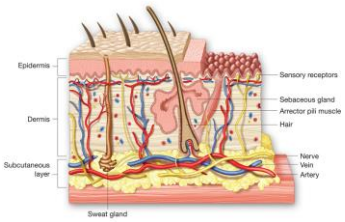
Integumentary System (1 of 3)

- Functions
  - Protection
  - Water balance
  - Temperature regulation
  - Excretion
  - Shock (impact) absorption

Integumentary System (2 of 3)

- Layers
  - Epidermis
  - Dermis
  - Subcutaneous

Integumentary System (3 of 3)

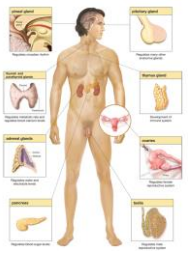


The layers of the skin.

Endocrine System (1 of 2)

- Produces hormones that regulate many body activities and functions
- Pancreas
- Adrenal glands
  - Secrete epinephrine

Endocrine System (2 of 2)



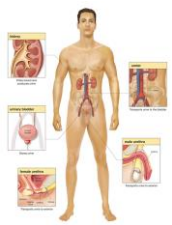
For long description, see slide 84: Appendix 9

The endocrine system.

Renal System (1 of 3)

- Urinary system
- Helps the body regulate fluid levels, filter chemicals, and adjust body pH
- Kidneys
  - Principal organs
- Bladder
  - Fluid reservoir for urine

Renal System (2 of 3)



For long description, see slide 85: Appendix 10

The renal/urinary system.

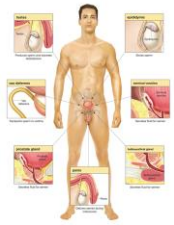
Renal System (3 of 3)

- Ureters
  - Transport urine to bladder from kidneys
- Urethra
  - Excretes urine from the bladder to external environment

Reproductive System (1 of 2)

- Male reproductive system
  - Testes
  - Penis

Male Reproductive System



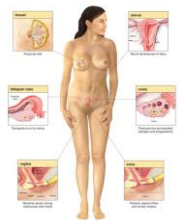
For long description, see slide 86: Appendix 11

The male reproductive system.

Reproductive System (2 of 2)

- Female reproductive system
  - Ovaries
  - Uterus
  - Vagina

Female Reproductive System



For long description, see slide 87: Appendix 12

The female reproductive system.

Chapter Review

Chapter Review (1 of 3)

- As an EMT, your knowledge of the anatomy, or structure, and the functions, or physiology, of the body will be important in allowing you to assess your patient and communicate your findings accurately and efficiently to other EMS personnel and hospital staff.

Chapter Review (2 of 3)

- Major body systems with which you should be familiar:
  - Musculoskeletal system
  - Respiratory system
  - Cardiovascular system
  - Nervous system
  - Digestive system

Chapter Review (3 of 3)

- Major body systems with which you should be familiar:
  - Integumentary system
  - Endocrine system
  - Renal system
  - Reproductive systems (male and female)

Remember (1 of 2)

- Cellular metabolism requires a constant supply of oxygen and glucose; absence of either component disrupts normal metabolism.
- Cardiopulmonary system combines the functions of respiratory and cardiovascular systems to provide oxygen at the cellular level.

Remember (2 of 2)

- Shock occurs when the cardiopulmonary system fails and cells become hypoperfused.
- The body is composed primarily of water, and this fluid is distributed throughout the body systems.

Questions to Consider (1 of 2)

- When evaluating a patient with a cardiac problem, consider the impact on the respiratory system. When evaluating a patient with a respiratory problem, consider the impact on the cardiovascular system. What impacts do problems in these systems have on each other?

Questions to Consider (2 of 2)

- Shock must be recognized immediately. What is the pathophysiology of shock?

Critical Thinking (1 of 2)

- You are treating a patient who was recently released from the intensive care unit with a massive infection (sepsis). This has impaired the patient's ability to regulate the size of the blood vessels.

Critical Thinking (2 of 2)

- How might this affect the patient's ability to compensate for any additional illnesses? What steps should you take to help this patient compensate?

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Appendix 1

The frontal bone is at the forehead of the skull, underneath which are the eye sockets surrounded by the orbits on the outside, the lacrimal bones on the inside, and the nasal bone at the center. Underneath those are the zygomatic bones, or cheekbones, and the maxilla of the upper jaw and the mandible of the lower jaw. At the side of the skull is the temporal bone. At the back of the skull are the parietal bone at the top and the occipital bone at the base. Sutures along the skull indicate where the bones have fused.

Return to presentation

Appendix 2

A side and back view of the human skeleton is displayed and the divisions are labeled from top to bottom. Underneath the skull is the cervical division, which contains seven vertebrae. The first vertebra is the Atlas and the second is the Axis. The thoracic division follows and contains 12 vertebrae. The lumbar division is next and contains six vertebrae. At the base of the spine are the sacrum and the coccyx or the tailbone.

Return to presentation

Appendix 3

An illustration of a man with his skeleton highlighted with the bones labeled throughout is present. At the top of the body is the skull, with the maxilla of the upper jaw and mandible of the lower jaw. The neck consists of the cervical vertebrae, which lead down the spine to the thoracic vertebrae, lumbar vertebrae, sacrum, and coccyx. At the top of the chest are the clavicles, which are followed by the ribs that connect together in the front at the sternum. In the back of the shoulders are the scapula, which lead down to the humerus in the upper arms, the ulna and radius of the lower arms, the carpals of the wrists, and the metacarpals of the hand, and phalanges of the fingers. The pelvis consists of the pubis in front and the ilium in back. In the legs, the femur leads to the patella in the knees, the tibia and fibula in the lower legs, the tarsals in the ankles, the metatarsals of the feet, and the phalanges in the toes.

Return to presentation

Appendix 4

In the illustration, a man with his respiratory system highlighted in his face, throat, and chest is displayed. Five enlarged images branch off to show the nasal cavity, pharynx and larynx, bronchial tubes, trachea, and lungs. Notes beside each of these give their respective functions. Nasal cavity, cleanses, warms, and humidifies inhaled air. Pharynx and larynx, carries air to the trachea and produces sound. Bronchial tubes, air passageways inside the lungs. Trachea, transports air to and from the lungs. Lungs, site of gas exchange between air and blood.

Return to presentation

Appendix 5

The respiratory system in the faces of both the child and the man are highlighted. The following describe the child's respiratory system. 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.

Return to presentation

Appendix 6

The following parts are labeled in the cross section of the heart. Superior vena cava, aorta, pulmonary valve, right atrium, left atrium, aortic valve, mitral or bicuspid valve, tricuspid valve, right ventricle, left ventricle, interventricular septum, myocardium or heart muscle, inferior vena cava, apex, and descending aorta. The right and left pulmonary artery branches pump blood to the lungs, while the right and left pulmonary vein branches bring oxygen from the lungs. These veins are attached to the right and left atriums, respectively. Blood is brought in from the body through the superior vena cava and the inferior vena cava, and is sent to the body through the descending aorta. The path of the blood flow inside the heart has six steps.

1. Blood enters the right atrium through the superior vena cava and the inferior vena cava.
2. Blood enters the right ventricle.
3. Blood goes to the lungs through the left pulmonary artery.
4. Blood enters the left atrium through the left pulmonary vein.
5. Blood enters the left ventricle.
6. Blood goes to the aortic valve.

Return to presentation

Appendix 7

The with the following parts labeled. Aorta, superior vena cava, left atrium, intermodal pathway, purkinje fibers, and interventricular septum. The cardiac conduction system includes the following parts.

1. Sinoatrial node, pacemaker
2. Atrioventricular node
3. Atrioventricular bundle, bundle of His
4. Bundle branches
5. Purkinje fibers

Return to presentation

Appendix 8

The illustration depicts an artery on the right branching into arterioles and a vein on the left branching into venules through a valve. The capillary bed connects the arterioles and the venules. A text reads as follows. From the heart, oxygen rich blood is carried out into the body by arteries. The arteries gradually branch into smaller arteries called arterioles. The arterioles gradually branch into tiny vessels called capillaries. In the capillaries, the blood gives up oxygen and nutrients, which move through the thin walls of the capillaries into the body's cells. At the same time, carbon dioxide and other wastes move in the opposite direction, from the cells and through the capillary walls, to be picked up by the blood. On its return journey to the heart, the oxygen poor blood, now carrying carbon dioxide and other wastes, flows from the capillaries into small veins called venules, which gradually merge into larger veins.

Return to presentation

Appendix 9

Diagram of the human endocrine system. Image shows an illustration of a man with his endocrine system highlighted. Seven enlarged images branch off to show different components of the system. An image of the pineal gland branches off from the brain with text that reads, regulates circadian rhythm. An image of the pituitary gland branches off from the brain with text that reads, regulates many other endocrine glands. An image of the thyroid and parathyroid glands branches off from the throat with text that reads, regulates metabolic rate and regulates blood calcium levels. An image of the thymus gland branches off from the chest with text that reads, development of immune system. An image of the adrenal glands branches off from above the kidneys with text that reads, regulates water and electrolyte levels. An image of the pancreas branches off from the abdomen with text that reads, regulates blood sugar levels. An image of a testis branches off from the pelvis with text that reads, regulates male reproductive system. An enlarged image of the ovaries shows the replacement for the testes in a female with text that reads, regulates female reproductive system.

Return to presentation

Appendix 10

Diagram of the human renal system. Image shows an illustration of a man with his renal system highlighted. Four enlarged images branch off to show different components of the system. An image of a kidney branches off with text that reads, filters blood and produces urine. An image of a ureter branches off with text that reads, transports urine to the bladder. An image of the urinary bladder branches off with text that reads, stores urine. An image of the male urethra shows the long urethra running through and out the penis with text that reads, transports urine to exterior. An enlarged image of the female urethra shows a shorter urethra running next to the vagina with text that reads, transports urine to exterior.

Return to presentation

Appendix 11

Diagram of the male reproductive system. Image shows an illustration of a man with his reproductive system highlighted. Seven enlarged images branch off from the pelvis to show different components of the system. An image of the testes branches off with text that reads, produces sperm and secretes testosterone. An image of the epididymis branches off with text that reads, stores sperm. An image of the vas deferens branches off with text that reads, transports sperm to urethra. An image of the seminal vesicles branches off with text that reads, secretes fluid for semen. An image of the prostate gland branches off with text that reads, secretes fluid for semen. An image of penis branches off with text that reads, delivers semen during intercourse. An image of the bulbourethral gland branches off with text that reads, secretes fluid for semen.

Return to presentation

Appendix 12

Diagram of the female reproductive system. Image shows an illustration of a woman with her reproductive system highlighted. Six enlarged images branch off from the pelvis and chest to show different components of the system. An image of a breast branches off with text that reads, produces milk. An image of the uterus branches off with text that reads, site of development of fetus. An image of a fallopian tube branches off with text that reads, transports ovum to uterus. An image of an ovary branches off with text that reads, produces ova and secretes estrogen and progesterone. An image of the vagina branches off with text that reads, receives semen during intercourse, birth canal. An image of the vulva branches off with text that reads, protects vaginal orifice and urinary meatus.

Return to presentation