DIVERSIFIED
HEALTH
OCCUPATIONS

Seventh Edition

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Chapter 7

Anatomy and Physiology

7:1 Basic Structure of the Human Body

- The normal function of the human body is compared to an organized machine
- The machine malfunctions, disease occurs
- Anatomy: study of form and structure
- Physiology: study of processes
- Pathophysiology: study of how disease occurs and body's response

Protoplasm

- Basic substance of life
- Made of ordinary elements (e.g., carbon, oxygen, hydrogen)
- Scientists can combine these elements, but not create life

Cells

- Made of protoplasm
- Microscopic organisms
- Carry on all functions of life
- Body contains trillions of cells
- Vary in shape and size
- Perform different functions

Basic Parts of Cells

- Cell membrane
- Cytoplasm
- Organelles
- Nucleus
- Nucleolus
- Chromatin
- Genome

(*continues*)

Basic Parts of Cells

(*continued*)

- Centrosome
- Mitochondria
- Golgi apparatus
- Endoplasmic reticulum
- Vacuoles
- Lysosomes
- Pinocytic vesicles

Mitosis

- Asexual reproduction process used by most cells
- Different types of cells reproduce at different rates
- Process of mitosis—see Figure 7-2 in text (p. 144)

Meiosis

- Process by which sex cells reproduce
- Uses two separate cell divisions
- Female cells (ova) and male cells (spermatozoa or sperm) divide to produce 23 chromosomes each
- When ova and sperm combine, 46 chromosomes result to form zygote

Tissues

- Cells of same type joined together
- 60%–99% water
- Groups of tissues
  - Epithelial
  - Connective
  - Nerve
  - Muscle

  (create a chart including 4 types of tissues and their function)

Organs and Systems

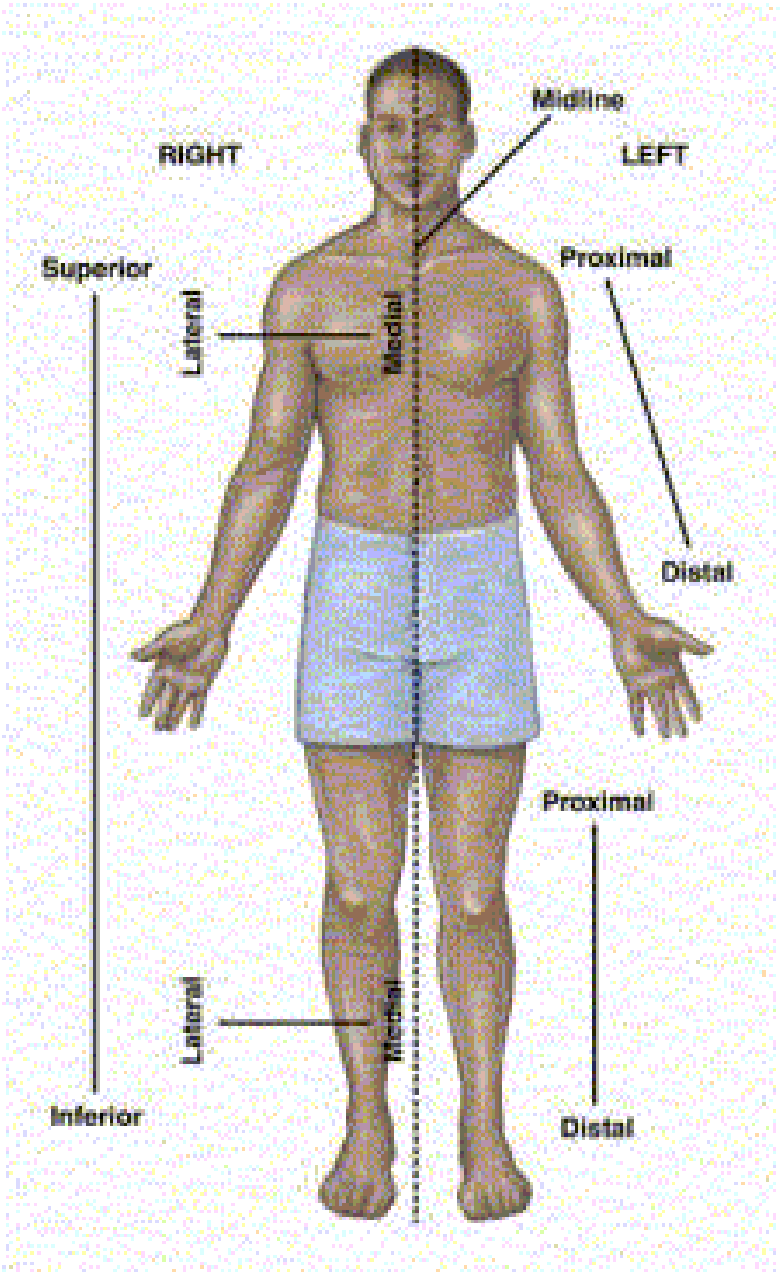
- Organs: two or more tissues joined together for a specific purpose
- Systems: organs and other body parts joined together for a particular function

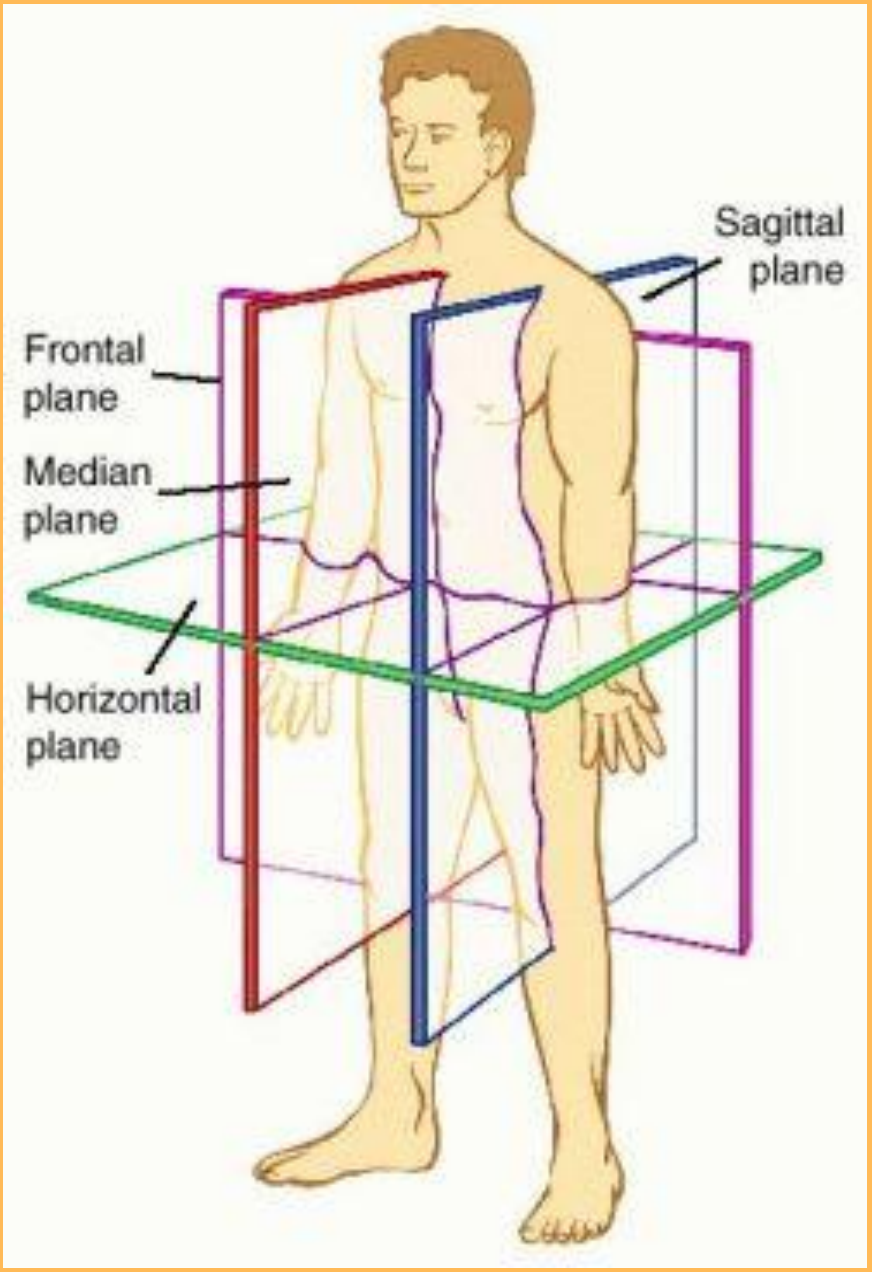
Summary

- Protoplasm is basic substance of life
- Protoplasm forms structural units called cells
- Cells combine to form tissue
- Tissues combine to form organs
- Organs and other parts combine to form systems
- Systems work together to create miracle of human body

7:2 Body Planes/Directions/Cavities

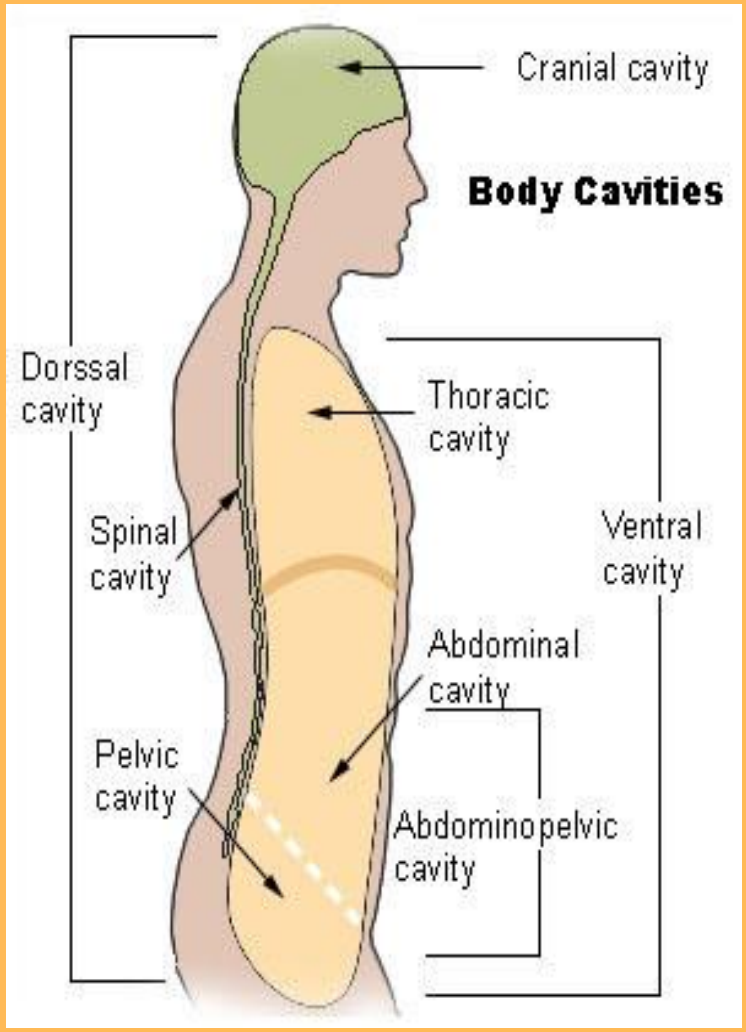
- Body planes: imaginary lines drawn through body at various levels to separate body into sections
- Directional terms are created by planes
- Transverse plane
- Midsagittal or median plane
- Frontal or coronal plane
- Proximal and distal

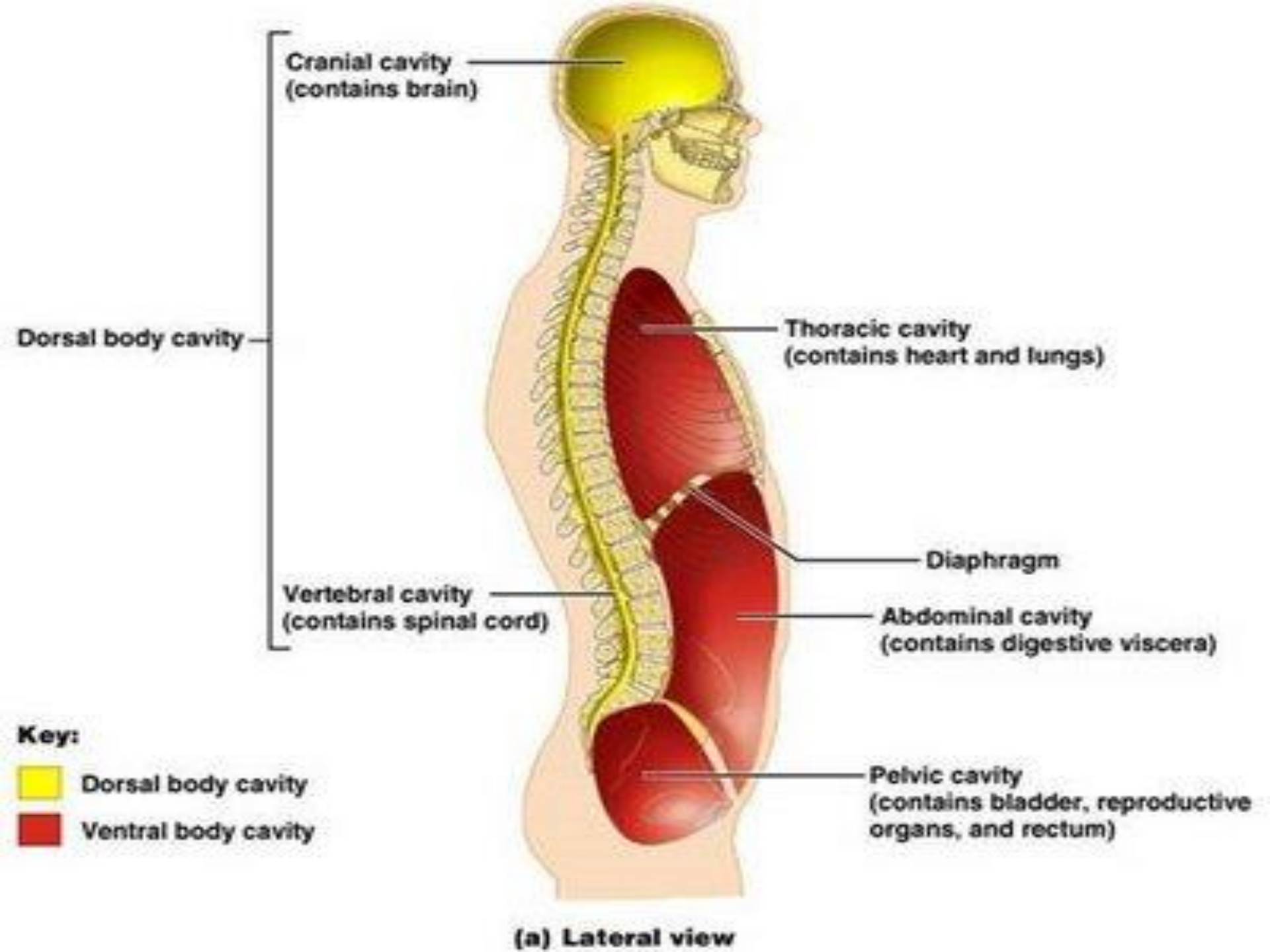




Cavities

- Spaces within the body that contain vital organs
- Dorsal or posterior cavity
  - cranial
  - spinal (vertebral canal)
- Ventral or anterior cavities
  - Thoracic cavity
  - Abdominal cavity
  - Pelvic cavity
- Three small cavities

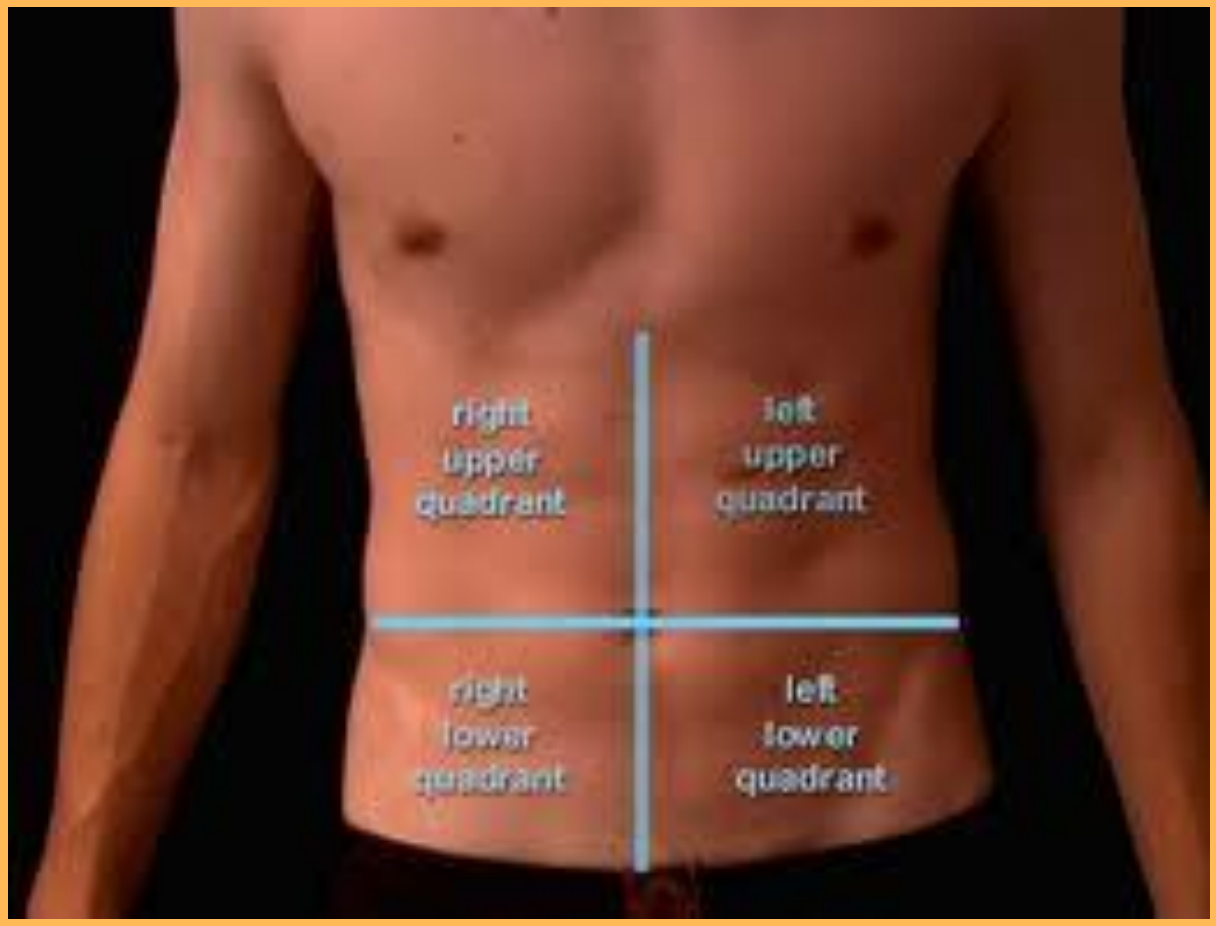




(a) Lateral view

Abdominal Regions

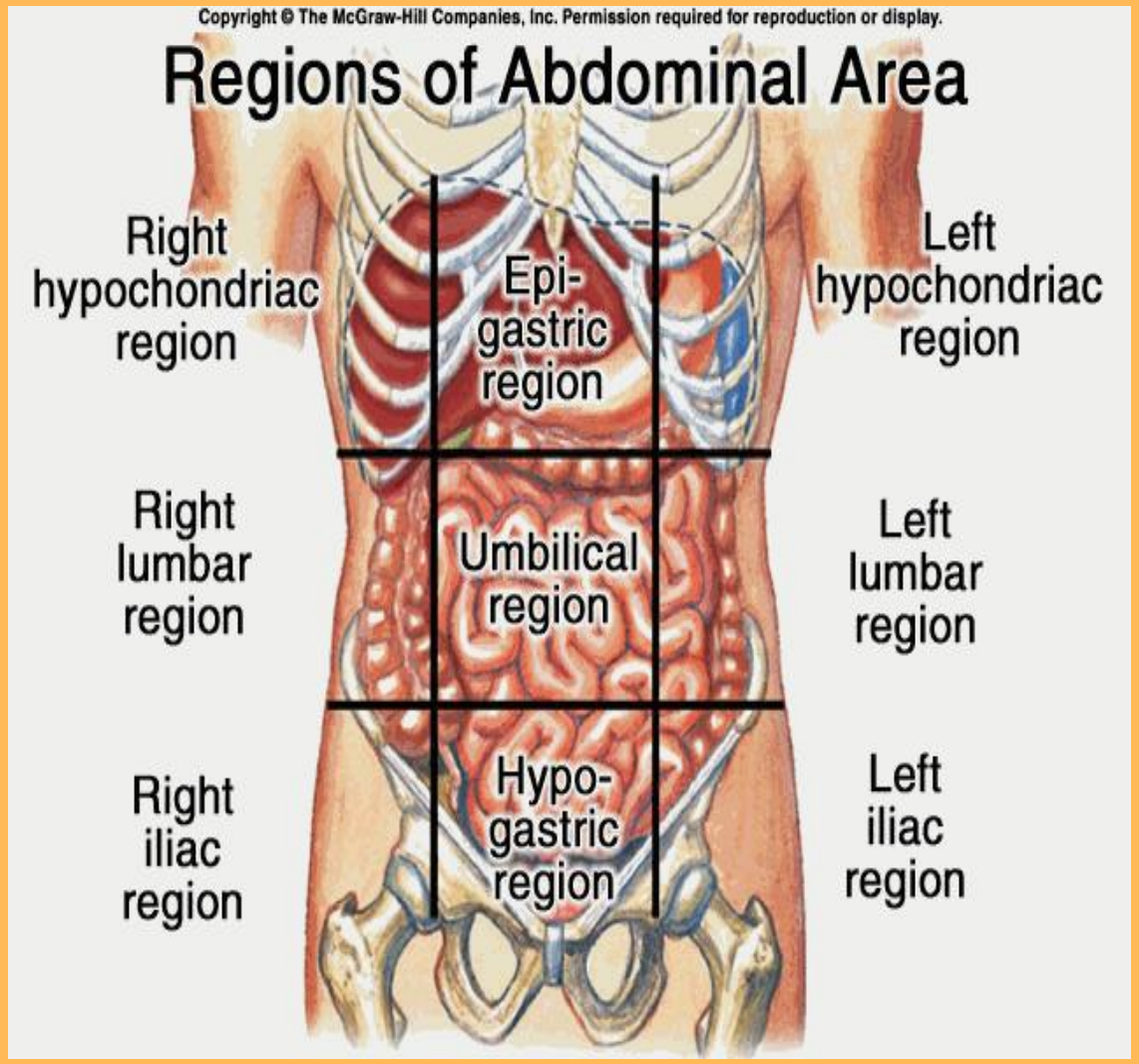
- Abdominal cavity is separated into regions or sections because it is so large
- Quadrants
  - RUQ
  - LUQ
  - RLQ
  - LLQ



Abdominal Regions

(*continued*)

- Regions
  - Epigastric
  - Umbilical
  - Hypogastric
  - Hypochondriac
  - Lumbar
  - Iliac or inguinal



7:3 Integumentary System

- Name for the skin and its structures
- Called a membrane because it covers the body
- Called an organ because it contains several kinds of tissues
- Called a system because it has organs and other parts that work together for a particular function

Layers of the Skin

- Epidermis—outermost layer
- Dermis—“true skin”
- Subcutaneous fascia or hypodermis—the innermost layer

Glands and Other Parts of the Skin

- Sudoriferous glands (sweat glands)
- Sebaceous glands (oil glands)
- Hair
- Nails

Functions

- Protection
- Sensory perception
- Regulation of body temperature
- Storage
- Absorption
- Excretion
- Production

Skin Color—Pigmentation

- Skin color is inherited and is determined by pigments in the epidermis
- Melanin
- Carotene

Skin Color—Albino

- Absence of skin pigments
- Skin has pinkish tint
- Hair is pale yellow or white
- Eyes are red in color and sensitive to light

Skin Color—Abnormal

- Erythema
- Jaundice
- Cyanosis

Skin Eruptions

- Macules (macular rash)
- Papules (papular rash)
- Vesicles
- Pustules
- Crusts
- Wheals
- Ulcer

Diseases and Abnormal Conditions

- Acne vulgaris
- Athlete's foot
- Skin cancer
  - Basal cell carcinoma
  - Squamous cell carcinoma
  - Melanoma

(*continues*)

Diseases and Abnormal Conditions

(*continued*)

- Dermatitis
- Eczema
- Impetigo
- Psoriasis
- Ringworm
- Verrucae/warts/plantar warts

7:4 Skeletal System

- Made of organs called bones
- Adult has 206 bones
- Serves as framework for muscles, fat, and skin
- Protects internal structures
- Produces blood cells
- Stores calcium, phosphorus, and fats

Long Bones

- Bones of the extremities
- Diaphysis
- Epiphysis
- Medullary canal
- Yellow marrow

(*continues*)

Long Bones
(*continued*)

- Endosteum
- Red marrow
- Periosteum
- Articular cartilage

Skeleton

- Axial
  - Main trunk of body
  - Skull, spinal column, ribs, and sternum
- Appendicular
  - Extremities
  - Shoulder girdle, arm bones, pelvic girdle, and leg bones

Skull

- Cranial and facial bones
- Sutures
- Sinuses
- Foramina

Cranial Bones

- Eight bones of skull that surround and protect the brain
- Frontal
- Parietal (2)
- Temporal (2)
- Occipital
- Ethmoid
- Sphenoid

Facial Bones

- 14 bones of skull that form facial features
- Mandible—lower jaw
- Maxilla (2)—upper jaw
- Zygomatic (2)—cheek
- Nasal (5)—upper part of nose
- Lacrimal (2)—inner aspect of eye
- Palatine (2)—hard palate (roof of mouth)

Vertebrae

- Spinal column—26 bones
- Protects the spinal cord
- Supports head and trunk
- Cervical (7)—neck
- Thoracic (12)—chest, attach to ribs
- Lumbar (5)—waist
- Sacrum (1)—back of pelvic girdle
- Coccyx (1)—tailbone

Intervertebral Disks

- Pads of cartilage separating vertebrae
- Act as shock absorbers
- Permit bending and twisting movements

Ribs (costae)

- 12 pairs of long slender bones
- Attach to thoracic vertebrae
- True ribs—first 7 pairs; attach to sternum
- False ribs—last 5 pairs

Sternum

- Breastbone
- Consists of 3 parts
- Two clavicles attach
- Ribs attach with cartilage

Shoulder or Pectoral Girdle

- 2 clavicles (collarbones)
- 2 scapula (shoulder bones)
- Upper arm bones attach to scapula

Bones of the Arm

- Humerus
- Radius
- Ulna
- Carpals
- Metacarpals
- Phalanges

Bones of Pelvic Girdle

- Consists of 2 os coxae (coxal or hip bones)
- Symphysis pubis
- Ilium
- Ischium
- Pubis
- Acetabula
- Obturator foramen

Bones of the Legs

- Femur
- Patella
- Tibia
- Fibula
- Tarsals
- Metatarsals
- Phalanges

Joints

- Where two or more bones join
- Ligaments
- Three types of joints
  - Diarthrosis or synovial
  - Amphiarthrosis
  - Synarthrosis

Diseases and Abnormal Conditions

- Arthritis
- Bursitis
- Fractures
- Dislocation
- Sprain
- Osteomyelitis

(*continues*)

Diseases and Abnormal Conditions

(*continued*)

- Osteoporosis
- Ruptured disk
- Abnormal curvature of spine
  - Kyphosis
  - Scoliosis
  - Lordosis

7:5 Muscular System

- 600+ muscles in the body
- Bundles of muscle fibers held together with connective tissue
- Properties of muscles
  - Excitability/irritability
  - Contractibility
  - Extensibility
  - Elasticity

Kinds of Muscles

- Cardiac—involuntary
- Visceral or smooth—involuntary
- Skeletal—voluntary

Functions of Muscles

- Attach to bones to provide movement
- Produce heat and energy
- Help maintain posture
- Protect internal organs

Attachments to Bone

- Tendon
- Fascia
- Origin and insertion

Actions or Movements of Muscles

- Adduction
- Abduction
- Flexion
- Extension
- Rotation
- Circumduction

Muscle Tone

- Partially contracted at all times
- Muscle tone allows for state of readiness
- Loss of muscle tone

Diseases and Abnormal Conditions

- Fibromyalgia
- Muscular dystrophy
- Duchenne's dystrophy
- Myasthenia gravis
- Muscle spasms or cramps
- Strain

7:6 Nervous System

- Complex and highly organized
- Coordinates all of the many activities of the body
- Allows the body to respond and adapt to changes that occur both inside and outside the body

Neuron

- Neuron is also called a nerve cell
- Basic structural unit of the nervous system
- Parts of neuron
  - Cell body
  - Nucleus
  - Nerve fibers (dendrites, axon)

Nerves

- Combination of nerve fibers
- Located outside the brain and spinal cord
- Afferent—sensory nerves
- Efferent—motor nerves
- Associative—internuncial nerves

Central Nervous System

- Consists of two main divisions
  - Central nervous system (CNS)
  - Brain and spinal cord
  - Peripheral nervous system
  - Somatic nervous system
  - Autonomic nervous system

Central Nervous System
The Brain

- Cerebrum
- Cerebellum
- Diencephalon
- Midbrain
- Pons
- Medulla oblongata

Central Nervous System
The Spinal Cord

- Continues down from medulla oblongata
- Surrounded and protected by the vertebrae
- Responsible for many reflex actions
- Carries sensory (afferent) messages to the brain
- Carries motor (efferent) message from the brain

Central Nervous System

- Meninges
- Dura mater
- Arachnoid membrane
- Pia mater
- Ventricles

Peripheral Nervous System

- Cranial nerves
- Spinal nerves
- Autonomic nervous system
  - Sympathetic
  - Parasympathetic

Diseases and Abnormal Conditions

- Amyotrophic lateral sclerosis (ALS)
- Carpal tunnel syndrome
- Cerebral palsy
- Cerebrovascular accident (CVA)
- Encephalitis
- Epilepsy or seizure syndrome

(*continues*)

Diseases and Abnormal Conditions

(*continued*)

- Hydrocephalus
- Meningitis
- Multiple sclerosis (MS)
- Neuralgia
- Paralysis
- Parkinson’s disease
- Shingles or herpes zoster

7:7 Special Senses

- Senses allow body to react to the environment
- See, hear, taste, smell, and to maintain balance
- Body structures receive sensation, nerves carry to brain, brain interprets and responds to message

Eye

- Sense of sight
- Light rays transmitted to the optic nerve
- Optic nerve relays information to brain
- Eye is well protected
  - Bony socket
  - Eyelids and eyelashes
  - Lacrimal glands
  - Conjunctiva

Layers of the Eye

- Sclera—outer
- Choroid coat—middle
- Retina—innermost

Other Special Structures

- Iris
- Pupil
- Lens
- Aqueous humor
- Vitreous humor
- Muscles

Diseases and Abnormal Conditions

- Amblyopia—lazy eye
- Astigmatism
- Cataract
- Conjuctivitis—pink eye
- Glaucoma

(*continues*)

Diseases and Abnormal Conditions

(*continued*)

- Hyperopia—farsightedness
- Myopia—nearsightedness
- Macular degeneration
- Presbyopia
- Strabismus

Ear

- Controls hearing and balance
- Sound waves transmitted to the auditory nerve
- Auditory nerve relays information to the brain for interpretation
- Consists of the outer ear, middle ear, and inner ear

Outer Ear

- Pinna or auricle
- Auditory canal
- Tympanic membrane

Middle Ear

- Malleus
- Incus
- Stapes
- Eustachian tube

Inner Ear

- Oval window
- Vestibule
- Cochlea
- Organ of Corti
- Semicircular canals

Diseases and Abnormal Conditions

- Hearing loss
- Meniere's disease
- Otitis externa
- Otitis media
- Otosclerosis

Sense of Taste

- Taste receptors located on the tongue
- Four main tastes
  - Sweet
  - Salty
  - Sour
  - Bitter

Sense of Smell

- Nose is the organ of smell
- Olfactory receptors in nasal cavity
- Impulses carried from the olfactory nerve to the brain for interpretation
- Humans can detect over 6,000 smells
- Sense of taste and smell related

Skin and General Senses

- Sense receptors for pressure, heat, cold, touch, and pain located in the skin and connective tissue
- Allows the human body to respond to its environment
- Help body react to conditions that could cause injury

7:8 Circulatory System

- Also known as the cardiovascular system
- Consists of heart, blood vessels, blood
- Transports oxygen and nutrients to all body cells
- Transports carbon dioxide and metabolic materials away from the body cells

Heart

- Muscular, hollow organ functions as pump
- Weight is less than one pound
- Location
- Three layers of tissue
  - Endocardium
  - Myocardium
  - Pericardium

(*continues*)

Heart
(*continued*)

- Septum
- Heart chambers
- Valves
  - Tricuspid
  - Pulmonary
  - Mitral
  - Aortic

(*continues*)

Heart
(*continued*)

- Cardiac cycle
- Conductive pathways
- Arrhythmias

Blood Vessels

- Blood is carried throughout the body in blood vessels
- Arteries
- Capillaries
- Veins

Blood

- Average adult: 4–6 quarts
- Transports many substances
- Plasma
- Blood cells
  - Erythrocytes or red blood cells
  - Leukocytes or white blood cells
  - Thrombocytes

Diseases and Abnormal Conditions

- Anemia
- Aneurysm
- Arteriosclerosis
- Atherosclerosis
- Congestive heart failure (CHF)
- Embolus

(*continues*)

Diseases and Abnormal Conditions

(*continued*)

- Hemophilia
- Hypertension
- Leukemia
- Myocardial infarction—heart attack
- Phlebitis
- Varicose veins

7:9 Lymphatic System

- Works with the circulatory system
- Removes waste and excess fluids from the body tissues
- Lymph
- Lymphatic vessels
- Lymph nodes (glands)

(*continues*)

Lymphatic System
(*continued*)

- Lymphatic ducts
- Lymph tissue
- Spleen
- Thymus

Diseases and Abnormal Conditions

- Adenitis
- Hodgkin's disease
- Lymphangitis
- Splenomegaly
- Tonsillitis

7:10 Respiratory System

- Lungs and air passages
- Takes oxygen in and removes carbon dioxide
- Works continuously or death occurs in 4–6 minutes

(*continues*)

Respiratory System
(*continued*)

- Nose
- Sinuses
- Pharynx—throat
- Larynx—voice box
- Trachea—windpipe
- Bronchi
- Alveoli
- Lungs

Ventilation

- Process of breathing
- Inspiration—inhalation
- Expiration—exhalation
- External respiration
- Internal respiration

Diseases and Abnormal Conditions

- Asthma
- Bronchitis
- Chronic obstructive pulmonary disease
- Emphysema
- Epistaxis—nosebleed

(*continues*)

Diseases and Abnormal Conditions

(*continued*)

- Influenza—flu
- Laryngitis
- Lung cancer
- Pleurisy
- Pneumonia

(*continues*)

Diseases and Abnormal Conditions

(*continued*)

- Rhinitis
- Sinusitis
- Sleep apnea
- Tuberculosis (TB)
- Upper respiratory infection (URI)

7:11 Digestive System

- Physical and chemical breakdown of food for use by the body
- System consists of the alimentary canal and the accessory organs

Alimentary Canal

- Long muscular tube
- Begins at the mouth and ends at the anus
- Accessory organs: salivary glands, tongue, teeth, liver, gallbladder, pancreas

Mouth, Buccal, or Oral Cavity

- Receives food as it enters the body
- Actions in the mouth
- Teeth
- Tongue
- Hard palate
- Soft palate
- Salivary glands

Pharynx or Throat

- Carrier for both air and food
- Carries food bolus to the esophagus
- When bolus swallowed, epiglottis closes to prevent food from entering respiratory tract

Esophagus

- Muscular tube dorsal to the trachea
- Carries bolus to stomach
- Peristalsis moves food toward stomach

Stomach

- Receives food from esophagus
- Mucous membrane lining contains rugae
- Cardiac sphincter
- Pyloric sphincter
- Food remains in stomach about 1–4 hours
- Gastric juices

Small Intestine

- About 20 feet long; 1 inch in diameter
- Receives food from the stomach in the form of chyme
- Small intestine
  - Duodenum
  - Jejunum
  - Ileum

(*continues*)

Small Intestine

(*continued*)

- Intestinal juices
- Bile
- Pancreatic juice
- Villi
- When food has finished its journey through the small intestine, only wastes, indigestible materials, and excess water remain

Large Intestine

- About 5 feet long; 2 inches in diameter
- Functions
- Cecum
- Colon
- Rectum

Liver

- Largest gland in the body
- Accessory organ for digestive system
- Location
- Functions

Gallbladder

- Small muscular sac
- Location
- Stores and concentrates bile
- Bile needed to emulsify fats

Pancreas

- Fish-shaped organ located behind the stomach
- Produces pancreatic juices to digest food
- Produces insulin which is secreted into the blood stream; regulates burning of carbohydrates to convert glucose to energy

Diseases and Abnormal Conditions

- Appendicitis
- Cholecystitis
- Cirrhosis
- Constipation
- Diarrhea
- Diverticulitis
- Gastroenteritis

(*continues*)

Diseases and Abnormal Conditions

(*continued*)

- Hemorrhoids
- Hepatitis
- Hernia or rupture
- Pancreatitis
- Peritonitis
- Ulcer
- Ulcerative colitis

7:12 Urinary System

- Excretory system
- Removes certain wastes and excess water from the body
- Maintains homeostasis
- Maintains acid-base balance
- 2 kidneys, 2 ureters, bladder, and urethra

Kidneys

- Bean-shaped organs
- Location
- Protection
- Cortex
- Medulla
- Hilum
- Nephrons

Ureters

- Muscular tubes about 10–12 inches long
- Extend from renal pelvis of each kidney to bladder
- Peristalsis moves urine through tube to bladder

Bladder

- Muscular sac
- Lined with mucous membranes
- Three layers of visceral muscle form walls
- Function
- Urge to void
- Circular sphincter muscles

Urethra

- Carries urine from bladder to the outside
- Urinary meatus
- Female and male systems
- Urine
- Conditions affecting urination

Diseases and Abnormal Conditions

- Cystitis
- Glomerulonephritis or nephritis
- Pyelonephritis
- Renal calculus or urinary calculus
- Renal failure
- Chronic renal failure
- Uremia
- Urethritis

7:13 Endocrine System

- Group of ductless (without tubes) glands
- Secrete substances called hormones
- Hormones that are secreted directly into bloodstream

Pituitary Gland

- Master gland of the body
- Located at the base of the brain
- Anterior and posterior lobes
- Acromegaly
- Giantism
- Diabetes insipidus
- Dwarfism

Thyroid Gland

- Regulates body's metabolism
- Located in neck
- Requires iodine from food intake
- Goiter
- Hyperthyroidism
- Graves' disease
- Hypothyroidism

Parathyroid Glands

- Attached to thyroid glands
- Regulate amount of calcium in the blood
- Hyperparathyroidism
- Hypoparathyroidism

Adrenal Glands

- Located above the kidneys
- Cortex
- Medulla
- Addison's disease
- Cushing's syndrome

Pancreas

- Located behind the stomach
- Both an exocrine and endocrine gland
- Diabetes mellitus

Other Endocrine Glands

- Ovaries: female sex glands, located in the pelvis, secrete hormones that regulate menstruation and secondary sexual characteristics
- Testes: male sex glands, located in the scrotal sac, produce hormones that regulate secondary sexual characteristics

Thymus

- Located in the upper part of chest
- Active in early life
- Atrophies (wastes away) during puberty
- Produces thymosin

Pineal Body

- Located in the brain
- Exact function unknown

Placenta

- Temporary endocrine gland produced during pregnancy
- Functions
- Expelled after the birth of the child

7:14 Reproductive System

- Function is to produce life
- Consists of gonads (sex glands) and accessory organs

Male Reproductive System

- Testes
- Scrotum
- Epididymis
- Vas deferens
- Seminal vesicles
- Ejaculatory ducts

(*continues*)

Male Reproductive System
(*continued*)

- Prostate gland
- Cowper's glands
- Urethra
- Penis

Diseases and Abnormal Conditions Male

- Epididymitis
- Orchitis
- Prostatic hypertrophy or hyperplasia
- Testicular cancer

Female Reproductive System

- Ovaries
- Fallopian tubes
- Uterus
- Vagina
- Bartholin’s glands
- Vulva
- Breasts or mammary glands

Diseases and Abnormal Conditions Female

- Breast tumors
- Cancer of the cervix and/or uterus
- Endometriosis
- Ovarian cancer
- Pelvic inflammatory disease (PID)
- Premenstrual syndrome (PMS)

Sexually Transmitted Diseases (STDs)

- AIDS
- Chlamydia
- Gonorrhea
- Herpes
- Pubic lice
- Syphilis
- Trichomonas vaginalis