Chapter 1
An Introduction to the Human Body

- Anatomy
  - science of structure
  - relationships revealed by dissection (cutting apart)
  - imaging techniques

- Physiology
  - science of body functions
  - normal adult physiology studied in this text
  - some genetic variations described

Levels of Organization

- Chemical
- Cellular
- Tissue
- Organs
- System Level
- Organismic Level

Levels of Structural Organization

- Chemical Level
  - atomic and molecular level
- Cellular level
  - smallest living unit of the body
- Tissue level
  - group of cells and the materials surrounding them that work together on one task
  - 4 basic tissue types
    - epithelium, muscle, connective tissue, and nerve
Levels of Structural Organization

- **Organ level**
  - grouping of 2 or more tissue types into a recognizable structure with a specific function.

- **Organ system**
  - collection of related organs with a common function
  - sometimes an organ is part of more than one system

- **Organismic level**
  - one living individual.

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Autopsy

- Postmortem examination of body by dissection

- **Purpose**
  - confirm or determine cause of death
  - support findings of other tests
  - provide information on effects of drug usage
  - educate healthcare students
  - reveal congenital defects

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Homeostasis of Body Fluids

- **Delineation of fluid compartments**
  - intracellular fluid (ICF) = within cells
  - extracellular fluid (ECF) = outside cells
  - intercellular fluid = tissue fluid = interstitial fluid
  - plasma = fluid portion of blood

- **Composition of fluids change as substances move between compartments**
  - nutrients, oxygen, ions and wastes move in both directions across capillary walls
Homeostatic Imbalances

- Disorder = abnormality of function
- Disease = homeostatic imbalance with distinct
  - symptoms—changes in body function felt by the
    patient such as nausea and
  - signs—changes in body function that can be observed
    by the doctor such as rash or fever
- Diagnosis—skill of distinguishing one disease
  from another
- Epidemiology—how disease is transmitted
- Pharmacology --- how drugs used to treat disease

Basic Anatomical Terminology

- Anatomical position
- Regions of the body
- Anatomical planes, sections and directional
terms

Anatomical Position

- Standardized position from which to
  describe directional terms
  - standing upright
  - facing the observer, head level
  - eyes facing forward
  - feet flat on the floor
  - arms at the sides
  - palms turned forward
- Prone position = lying face down
- Supine position = lying face up
  anatomical position?
Common Regional Names

- Clinical terminology based on a Greek or Latin root word.

Planes and Sections

- A plane is an imaginary flat surface that passes through the body.
- A section is one of the 2 surfaces (pieces) that results when the body is cut by a plane passing through it.

Sagittal Plane

- Sagittal plane
  - divides the body or an organ into left and right sides
- Midsagittal plane
  - produces equal halves
- Parasagittal plane
  - produces unequal halves
Other Planes and Sections

- Frontal or coronal plane
  - divides the body or an organ into front (anterior) and back (posterior) portions
- Transverse (cross-sectional) or horizontal plane
  - divides the body or an organ into upper (superior) or lower (inferior) portions
- Oblique plane
  - some combination of 2 other planes

Planes and Sections of the Brain
(3-D anatomical relationships revealed)

- Horizontal Plane
- Frontal Plane
- Midsagittal Plane

Major Directional Terms
Superior or Inferior

- Superior
  - towards the head
  - The eyes are superior to the mouth.
- Inferior
  - away from the head
  - The stomach is inferior to the heart.

Dorsal or Ventral

- Dorsal or Posterior
  - at the back of the body
  - The brain is posterior to the forehead.
- Ventral or Anterior
  - at the front of the body
  - The sternum is anterior to the heart.

Medial or Lateral

- Medial
  - nearer to the midline of the body
  - The heart lies medial to the lungs.
- Lateral
  - farther from the midline of the body
  - The thumb is on the lateral side of the hand.
Proximal or Distal
• Proximal
  – nearer to the attachment of the limb to the trunk
  – The knee is proximal to the ankle.
• Distal
  – farther from the attachment of the limb to the trunk
  – The wrist is distal to the elbow.

Dorsal Body Cavity
• Near dorsal surface of body
• 2 subdivisions
  – cranial cavity
    • holds the brain
    • formed by skull
  – vertebral or spinal canal
    • contains the spinal cord
    • formed by vertebral column
• Meninges line dorsal body cavity

Ventral Body Cavity
• Near ventral surface of body
• 2 subdivisions
  – thoracic cavity above diaphragm
  – abdominopelvic cavity below diaphragm
• Diaphragm = large, dome-shaped muscle
• Organs called viscera
• Organs covered with serous membrane
Abdominopelvic Cavity

- Inferior portion of ventral body cavity below diaphragm
- Encircled by abdominal wall, bones & muscles of pelvis

Thoracic Cavity

- Encircled by ribs, sternum, vertebral column and muscle
- Divided into 2 pleural cavities by mediastinum
- Mediastinum contains all thoracic organs except lungs

Mediastinum

- Midline wall of tissue that contains heart and great vessels, esophagus, trachea and thymus.
Serous Membranes

- Thin slippery membrane lines body cavities not open to the outside
  - parietal layer lines walls of cavities
  - visceral layer covers viscera within the cavities
- Serous fluid reduces friction

Pleural & Pericardial Cavities

- Visceral pleura clings to surface of lungs --- Parietal pleura lines chest wall
- Visceral pericardium covers heart --- Parietal pericardium lines pericardial sac

Peritoneum

- Visceral peritoneum --- serous membrane that covers the abdominal viscera
- Parietal peritoneum --- serous membrane that lines the abdominal wall
Abdominopelvic Regions & Quadrants

• Describe locations of organs or source of pain
• Tic-tac-toe grid or intersecting lines through navel

Medical Imaging

• Allows visualization of structures without surgery
• Useful for confirmation of diagnosis
• Examples of imaging techniques

Conventional Radiography

• A single burst of xrays
• Produces 2-D image on film
• Known as radiography or xray
• Poor resolution of soft tissues
• Major use is osteology
Computed Tomography (CT Scan)

- Moving x-ray beam
- Image produced on a video monitor of a cross-section through body
- Computer generated image reveals more soft tissue detail
  - kidney & gallstones
- Multiple scans used to build 3D views

Digital Subtraction Angiography (DSA)

- Radiopaque material injected into blood vessels
- Before and after images compared with a computer program
- Image of blood vessel is shown on a monitor

Ultrasound (US)

- High-frequency sound waves emitted by hand-held device
- Safe, noninvasive & painless
- Image or sonogram is displayed on video monitor
- Used for fetal ultrasound and examination of pelvic & abdominal organs, heart and blood flow through blood vessels
Magnetic Resonance Imaging (MRI)

- Body exposed to high-energy magnetic field
- Protons align themselves relative to magnetic field
- Pulse of radiowaves used to generate an image on video monitor
- Can not use on patient with metal in their body
- Reveals fine detail within soft tissues

Positron Emission Tomography (PET)

- Substance that emits positively charged particles is injected into body
- Collision with negatively charged electrons in tissues releases gamma rays
- Camera detects gamma rays & computer generates image displayed on monitor