

Overview of Anatomy and Physiology

- **Anatomy** – the study of the *structure* of body parts and their relationships to one another
 - Gross or macroscopic
 - Microscopic
 - Developmental
- **Physiology** – the study of the *function* of the body's structural machinery

Gross Anatomy

- **Regional** – all structures in one part of the body (such as the abdomen or leg)
- **Systemic** – gross anatomy of the body studied by system
- **Surface** – study of internal structures as they relate to the overlying skin

Microscopic Anatomy

- **Cytology** – study of the cell
- **Histology** – study of tissues

Developmental Anatomy

- **Embryology** – study of developmental changes of the body before birth

Physiology

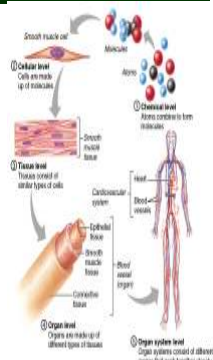
- Considers the operation of specific organ systems
 - **Renal** – kidney function
 - **Neurophysiology** – workings of the nervous system
 - **Cardiovascular** – operation of the heart and blood vessels
- Focuses on the functions of the body, often at the cellular or molecular level
- Understanding physiology also requires a knowledge of physics, which explains electrical currents, blood pressure, and the way muscle uses bone for movement

Principle of Complementarity

- Function always reflects structure
- What a structure can do depends on its specific form

Levels of Structural Organization

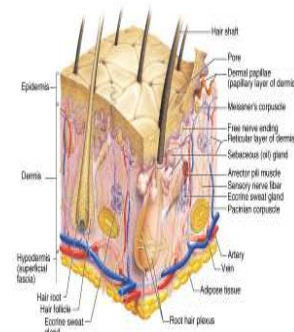
- **Chemical** – atoms combined to form molecules
- **Cellular** – cells are made of molecules
- **Tissue** – consists of similar types of cells
- **Organ** – made up of different types of tissues
- **Organ system** – consists of different organs that work closely together
- **Organismal** – made up of the organ systems



Organ Systems of the Body

Integumentary system

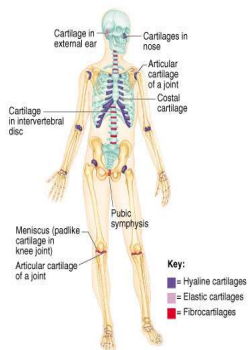
- Forms the external body covering
- Composed of the skin, sweat glands, oil glands, hair, and nails
- Protects deep tissues from injury and synthesizes vitamin D



Organ Systems of the Body

Skeletal system

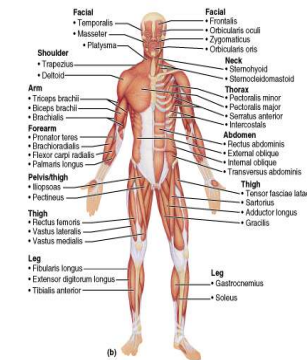
- Composed of bone, cartilage, and ligaments
- Protects and supports body organs
- Provides the framework for muscles
- Site of blood cell formation
- Stores minerals



Organ Systems of the Body

Muscular system

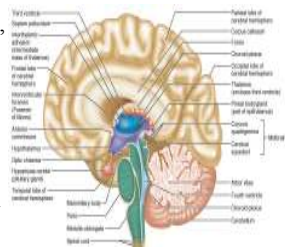
- Composed of muscles and tendons
- Allows manipulation of the environment, locomotion, and facial expression
- Maintains posture
- Produces heat



Organ Systems of the Body

Nervous system

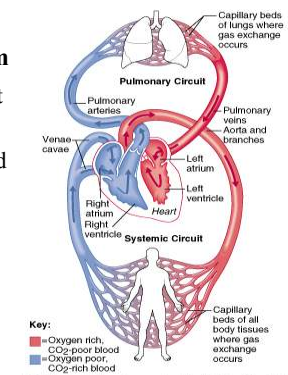
- Composed of the brain, spinal column, and nerves
- Is the fast-acting control system of the body
- Responds to stimuli by activating muscles and glands



Organ Systems of the Body

Cardiovascular system

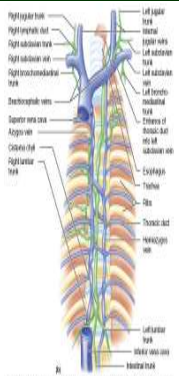
- Composed of the heart and blood vessels
- The heart pumps blood
- The blood vessels transport blood throughout the body



Organ Systems of the Body

Lymphatic system

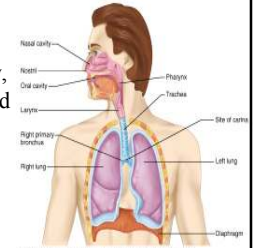
- Composed of red bone marrow, thymus, spleen, lymph nodes, and lymphatic vessels
- Picks up fluid leaked from blood vessels and returns it to blood
- Disposes of debris in the lymphatic stream
- Houses white blood cells involved with immunity



Organ Systems of the Body

Respiratory system

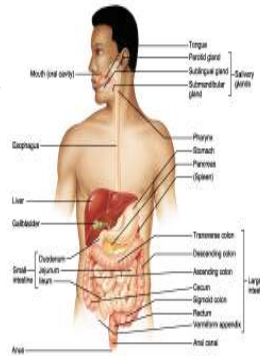
- Composed of the nasal cavity, pharynx, trachea, bronchi, and lungs
- Keeps blood supplied with oxygen and removes carbon dioxide



Organ Systems of the Body

Digestive system

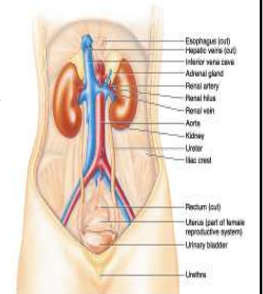
- Composed of the oral cavity, esophagus, stomach, small intestine, large intestine, rectum, anus, and liver
- Breaks down food into absorbable units that enter the blood
- Eliminates indigestible foodstuffs as feces



Organ Systems of the Body

Urinary system

- Composed of kidneys, ureters, urinary bladder, and urethra
- Eliminates nitrogenous wastes from the body
- Regulates water, electrolyte, and pH balance of the blood



Organ Systems of the Body

Male reproductive system

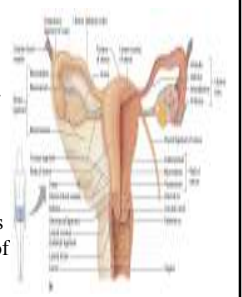
- Composed of prostate gland, penis, testes, scrotum, and ductus deferens
- Main function is the production of offspring
- Testes produce sperm and male sex hormones
- Ducts and glands deliver sperm to the female reproductive tract



Organ Systems of the Body

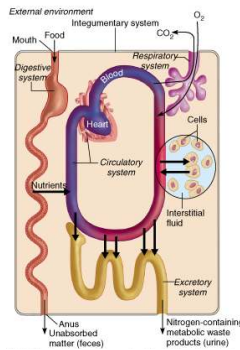
Female reproductive system

- Composed of mammary glands, ovaries, uterine tubes, uterus, and vagina
- Main function is the production of offspring
- Ovaries produce eggs and female sex hormones
- Remaining structures serve as sites for fertilization and development of the fetus
- Mammary glands produce milk to nourish the newborn



Organ System Interrelationships

- The integumentary system protects the body from the external environment
- Digestive and respiratory systems, in contact with the external environment, take in nutrients and oxygen
 - Nutrients and oxygen are distributed by the blood
 - Metabolic wastes are eliminated by the urinary and respiratory systems



Necessary Life Functions I

- **Maintaining boundaries** – the internal environment remains distinct from the external
 - Cellular level – accomplished by plasma membranes
 - Organismal level – accomplished by the skin
- **Movement** – locomotion, propulsion (peristalsis), and contractility
- **Responsiveness** – ability to sense changes in the environment and respond to them
- **Digestion** – breakdown of ingested foodstuff

Necessary Life Functions II

- **Metabolism** – all the chemical reactions that occur in the body
- **Excretion** – removal of wastes from the body
- **Reproduction** – cellular and organismal levels
 - Cellular – an original cell divides and produces two identical daughter cells
 - Organismal – sperm and egg unite to make a whole new person
- **Growth** – increase in size of a body part or of the organism

Survival Needs

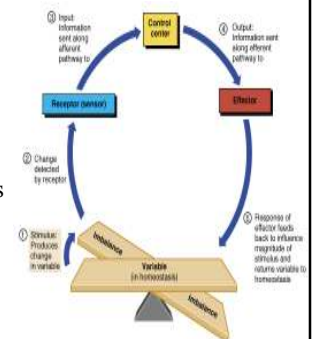
- **Nutrients** – chemical substances used for energy and cell building
- **Oxygen** – needed for metabolic reactions
- **Water** – provides the necessary environment for chemical reactions
- **Maintaining normal body temperature** – necessary for chemical reactions to occur at life-sustaining rates
- **Atmospheric pressure** – required for proper breathing and gas exchange in the lungs

Homeostasis

- Homeostasis is the ability to maintain a relatively stable internal environment in an ever-changing outside world
- The internal environment of the body is in a dynamic state of equilibrium
- Chemical, thermal, and neural factors interact to maintain homeostasis

Homeostatic Control Mechanisms

- Variable produces a change in the body
- Receptor monitors the environments and responds to changes (stimuli)
- Control center determines the set point at which the variable is maintained
- Effector provides the means to respond to the stimulus



Negative Feedback

- In negative feedback systems, the output shuts off the original stimulus
- Example: Regulation of blood glucose levels

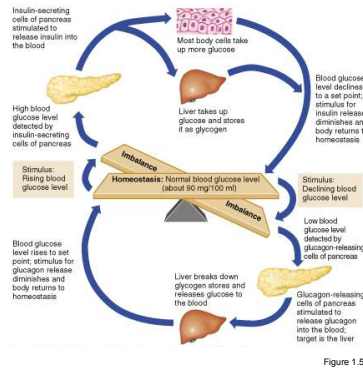


Figure 1.5

Positive Feedback

- In positive feedback systems, the output enhances or exaggerates the original stimulus
- Example: Regulation of blood clotting

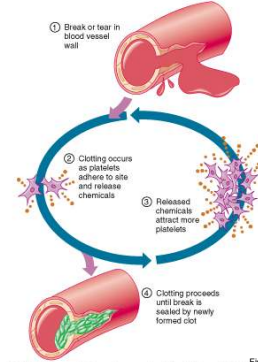


Figure 1.6

Homeostatic Imbalance

- Disturbance of homeostasis or the body's normal equilibrium caused by disease
- Overwhelming of negative feedback mechanisms allowing destructive positive feedback mechanisms to take over

Anatomical Position

- Body erect, feet slightly apart, palms facing forward, thumbs point away from the body

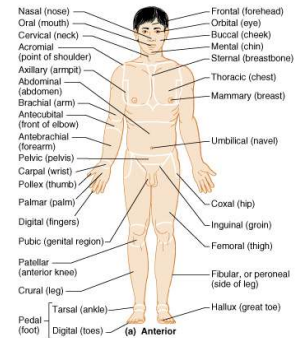


Figure 1.7a

Directional Terms

- **Superior and inferior** – toward and away from the head, respectively
- **Anterior and posterior** – toward the front and back of the body
- **Medial, lateral, and intermediate** – toward the midline, away from the midline, and between a more medial and lateral structure
- **Proximal and distal** – closer to and farther from the origin of the body
- **Superficial and deep** – toward and away from the body surface





Directional Terms

Term	Definition	Example
Superior (cranial)	Toward the head end or upper part of a structure or the body; above	The head is superior to the abdomen
Inferior (caudal)	Away from the head end or toward the lower part of a structure or the body; below	The navel is inferior to the chin
Anterior (ventral)*	Toward or at the front of the body; in front of	The breastbone is anterior to the spine

*Whereas the terms ventral and anterior are synonymous in humans, this is not the case in four-legged animals. Ventral specifically refers to the "belly" of a vertebrate animal and thus is the inferior surface of four-legged animals. Likewise, although the dorsal and posterior surfaces are the same in humans, the term dorsal specifically refers to an animal's back. Thus, the dorsal surface of four-legged animals is their superior surface.

Directional Terms





TABLE 1.1 Orientation and Directional Terms

Term	Definition	Example
Posterior (dorsal)*	Toward or at the back of the body; behind	 The heart is posterior to the breastbone
Medial	Toward or at the midline of the body; on the inner side of	 The heart is medial to the arm
Lateral	Away from the midline of the body; on the outer side of	 The arms are lateral to the chest
Intermediate	Between a more medial and a more lateral structure	 The collarbone is intermediate between the breastbone and shoulder

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Directional Terms

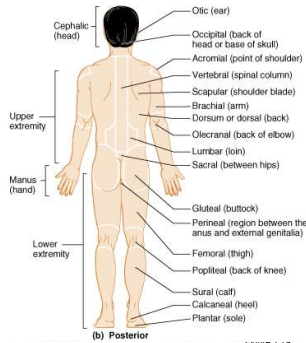
TABLE 1.1 Orientation and Directional Terms

Term	Definition	Example
Proximal	Closer to the origin of the body part or the point of attachment of a limb to the body trunk	 The elbow is proximal to the wrist
Distal	Farther from the origin of a body part or the point of attachment of a limb to the body trunk	 The knee is distal to the thigh
Superficial (external)	Toward or at the body surface	 The skin is superficial to the skeletal muscles
Deep (internal)	Away from the body surface; more internal	 The lungs are deep to the skin

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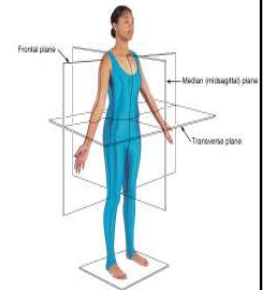
Regional Terms

- **Axial** – head, neck, and trunk
- **Appendicular** – appendages or limbs
- **Specific regional terminology**



Body Planes

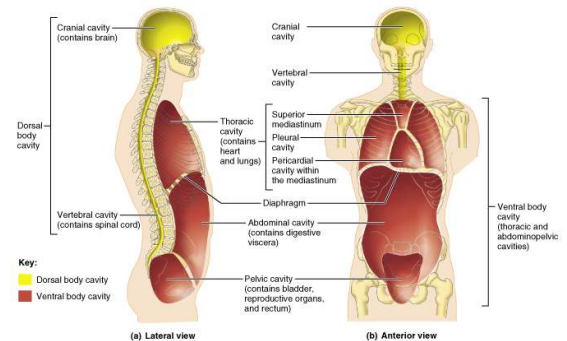
- **Sagittal and medial** – divides the body into right and left parts
- **Midsagittal** – sagittal plane that lies on the midline
- **Frontal or coronal** – divides the body into anterior and posterior parts
- **Transverse or horizontal (cross section)** – divides the body into superior and inferior parts
- **Oblique section** – cuts made diagonally



Body Cavities

- **Dorsal cavity** protects the nervous system, and is divided into two subdivisions
 - **Cranial cavity** is within the skull and encases the brain
 - **Vertebral cavity** runs within the vertebral column and encases the spinal cord
- **Ventral cavity** houses the internal organs (viscera), and is divided into two subdivisions: thoracic and abdominopelvic

Body Cavities



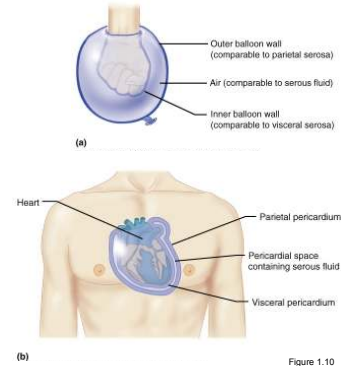
Body Cavities

Thoracic cavity is subdivided into pleural cavities, the mediastinum, and the pericardial cavity

- **Pleural cavities** – each houses a lung
- **Mediastinum** – contains the pericardial cavity, and surrounds the remaining thoracic organs
- **Pericardial** – encloses the heart
- The **abdominopelvic cavity** is separated from the superior thoracic cavity by the dome-shaped diaphragm
- It is composed of two subdivisions
 - **Abdominal cavity** – contains the stomach, intestines, spleen, liver, and other organs
 - **Pelvic cavity** – lies within the pelvis and contains the bladder, reproductive organs, and rectum

Ventral Body Cavity Membranes

- **Parietal serosa** covering the body walls
- **Visceral serosa** covering the internal organs
- **Serous fluid** separates the serosae

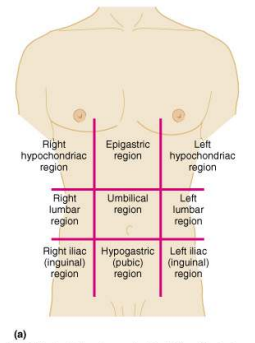


Other Body Cavities

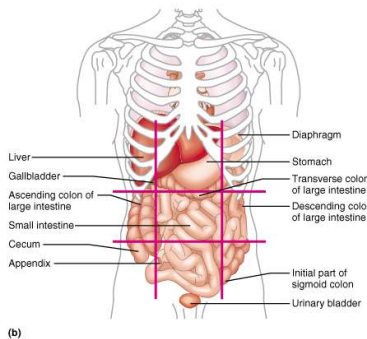
- **Oral and digestive** – mouth and cavities of the digestive organs
- **Nasal** – located within and posterior to the nose
- **Orbital** – house the eyes
- **Middle ear** – contain bones (ossicles) that transmit sound vibrations
- **Synovial** – joint cavities

Abdominopelvic Regions

- Umbilical
- Epigastric
- Hypogastric
- Right and left iliac or inguinal
- Right and left lumbar
- Right and left hypochondriac



Abdominopelvic Regions



Abdominopelvic Quadrants

- Right upper
- Left upper
- Right lower
- Left lower

