The Human Body: An Orientation

What is Anatomy and Physiology?

Anatomy – studies the structure of body parts and their relationships to one another

Physiology – study of how the body functions individually and cooperatively

- The structure determines what functions can take place.

<table>
<thead>
<tr>
<th>Types of Anatomy</th>
<th>Study of.....</th>
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<tbody>
<tr>
<td>Macroscopic or Gross Anatomy</td>
<td>Study of large body structures visible to the eye</td>
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<tr>
<td>Regional Anatomy</td>
<td>Gross anatomy studying all structures in one part of body (one region)</td>
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<tr>
<td>Surface Anatomy</td>
<td>Gross anatomy studying how internal structures relate to skin</td>
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<tr>
<td>Systemic Anatomy</td>
<td>Gross anatomy studied by system</td>
</tr>
<tr>
<td>Microscopic Anatomy</td>
<td>Study micro detail of structure – can’t be seen with naked eye</td>
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<tr>
<td>Cytology</td>
<td>Study of cells</td>
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<tr>
<td>Histology</td>
<td>Study of tissue</td>
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<tr>
<td>Developmental Anatomy</td>
<td>Changes from conception to old age</td>
</tr>
<tr>
<td>Embryology</td>
<td>Study of changes within the embryo/fetus</td>
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Levels of Organization

- Cell – the smallest unit(s) of life
- Tissue – consist of groups of similar cells that have a common function; epithelial, connective, muscular, nervous
- Organs – structure composed of two or more tissue types and performs a specific function
- Organ Systems – group of organs that cooperate to accomplish a common purpose

System | Major Structures | Functions |
|--------|-----------------|-----------|
| Integumentary | Skin, hair, nails |✅ Forms the external body covering and protects deeper tissue from injury.  
✅ Contains sweat and oil glands that excretes salts/urea  
✅ Helps regulate body temperatures  
✅ Synthesizes vitamin D and contains cutaneous receptors (pain, pressure, etc.) |
| Skeletal | Bones, cartilage, ligaments |✅ Supports and protects internal organs  
✅ Provides levers for muscular action  
✅ Stores minerals – Calcium, etc.  
✅ Site for blood cell formation |
| Muscular | Muscles, tendons |✅ Provide support, protection, movement, posture, body heat |
| Nervous | Brain, spinal cord, nerves |✅ Allows body to detect changes in its internal & external environment and responds to such information by activating muscles or glands  
✅ Helps maintain short-term homeostasis of the body by rapidly transmitting electrical signals |
| Endocrine | Glands, hormones |✅ Glands secrete hormones that control activities such as growth, reproduction, etc.  
✅ Plays a role in regulating long-term homeostasis |
Cardiovascular

<table>
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<tr>
<th>Heart, vessels, blood</th>
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<tr>
<td>Vessels carry blood containing oxygen, carbon dioxide, nutrients, wastes, ions, hormones and other substances to and from the cells where exchanges are made; pumping action of heart propels blood through vessels.</td>
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<tr>
<td>Protects body with blood clots, antibodies and other protein molecules in blood.</td>
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Lymphatic & Immune

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<th>Lymphatic vessels, lymph nodes</th>
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<tbody>
<tr>
<td>Cleans and returns tissue fluid to the blood.</td>
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<tr>
<td>Picks up fluid leaked from blood vessels and returns it to blood.</td>
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<tr>
<td>Disposes of debris in the lymphatic stream.</td>
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<tr>
<td>Cleanses blood of pathogens and other debris.</td>
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<tr>
<td>Houses white blood cells involved in immunity.</td>
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<tr>
<td>The immune response mounts the attack against foreign substances within the body.</td>
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Respiratory

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<th>Lungs, bronchi, trachea</th>
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<tr>
<td>Keeps blood constantly supplied with oxygen and removes carbon dioxide. The gaseous exchanges occur through the walls of the air sacs of the lungs.</td>
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Digestive

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<td>Breaks down ingested food into tiny particles, which can be absorbed into the blood for distribution to body cells.</td>
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<tr>
<td>Undigested materials leaves the body as feces.</td>
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Urinary

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<th>Kidneys, ureter, urethra, bladder</th>
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<td>Filters the blood and then rids the body of nitrogenous wastes.</td>
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<tr>
<td>Regulates water, electrolyte and acid-base balance of the blood.</td>
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Reproductive

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<th>Ovaries, testes, uterus</th>
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<td>Produces germ cells for producing offspring.</td>
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<td>Production of sex hormones.</td>
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Maintaining LIFE – Necessary Life Functions

- Maintain Boundaries – separate internal and external environment with cell membranes
- Movement - self initiated change in position, motion of internal parts
- Responsiveness (irritability) - Ability to sense changes and react to them
- Growth - increase in size
- Reproduction – can occur at the cellular or organismal level
- Respiration – Exchange and use gases
- Digestion - Chemically changing food substances, and getting rid of wastes
- Absorption - Passage of digested products through membranes into fluids
- Circulation - Movement of substances throughout the body
- Excretion - Removal of wastes
- Metabolism – refers to all chemical reactions within the body (catabolism – breaking down substances; anabolism – synthesizing substances)

Interdependence of body cells

- Organ systems cooperate to maintain life. (see diagram)
**SURVIVAL Needs:**

**Nutrients** – contain chemicals used for energy and construction of a cell. Carbohydrates and lipids are used for energy. Proteins and lipids are used for construction of the cell. Minerals and vitamins are needed for chemical reactions.

**Oxygen** – needed for chemical reactions that release energy for food.

**Water** – accounts for 60-80% of body weight and provides the fluid base for body secretions and excretions.

**Body Temperature** – body must maintain temp around 37°C (98°F) because metabolic reactions are affected at other temps.

**Atmospheric Pressure** – breathing and the exchange of O₂ and CO₂ in the lungs depend on appropriate atmospheric pressure.

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**HOMEOSTASIS:** Tendency of the body to maintain a stable, balanced internal environment. Balance is accomplished through self regulating adjustments made by the nervous and endocrine system.

- It is a dynamic state of equilibrium or balance in which internal conditions vary, but always within relatively narrow limits.
- It involves continuous monitoring and regulation of all factors that can change. Communication between the endocrine and nervous systems are essential.
- Interactions of a homeostatic control system to maintain stable internal conditions. (see diagram)
Feedback Mechanisms

- Negative feedback mechanism – response reduces or shuts off original stimulus; most common feedback mechanism in body. Examples: body temperature regulation, regulation of blood glucose levels, etc...
- The body’s ability to regulate its internal environment is fundamental and all negative feedback mechanisms have the same goal: preventing sudden severe changes within the body.
- Homeostatic Imbalances – most diseases can be regarded as a result of its body disturbances

- Positive feedback mechanism – response enhances or exaggerates original stimulus; may exhibit an amplifying effect
- Usually controls infrequent events that do not require continuous adjustments. Example: enhancement of labor contractions by oxytocin, platelet plug formation and blood clotting, etc...
The Language of Anatomy

**Anatomical Position** is used as a reference point to accurately describe body parts and position. The body is erect with feet parallel and arms hanging at the sides with the palms facing forward.

**Directional Terms:**
Terms used to explain exactly where one body structure is in relation to another. Always use directional terms as if body is in anatomical position

- Anterior – toward or at the front of body; in front of
- Posterior – toward or at the backside of body; behind
- Superior – toward the head end or upper part of structure or body; above
- Inferior – away from head end or toward lower part of a structure or body; below
- Medial – toward or at the midline of body; on the inner side of
- Lateral – away from the midline of body; on the outer side
- Intermediate – between a more medial and a more lateral structure
- Proximal – close to the origin of the body part or point of attachment of a limb to the body trunk
- Distal – farther from the origin of the body part or point of attachment of a limb to the body trunk
- Superficial – toward or at the body surface
- Deep – away from the body surface; more internal

**Body Planes or Sections:**
When looking at internal structures, it’s necessary to make a section or cut. When the section is made through the body wall or organ, it is made along an imaginary line called a plane.

- Frontal (coronal) Plane – divides the body into anterior and posterior parts
- Sagittal Plane – divides the body into unequal right and left parts
- Midsagittal (median) Plane – a sagittal plane that divides the body into equal left and right sides
- Transverse Plane (cross-section) – divides the body into superior and inferior parts
- Oblique Plane – divides the body at an angle

- New medical imaging devices produce sectional images rather than 3-D images.
Regional Terms:
There are two major divisions of the body – axial and appendicular. These terms are used to designate specific areas of the body.
**Body Cavities:**
These are internal cavities that provide different degrees of protection to the organs within them.

1. **Dorsal Cavity** is composed of two subdivisions.
   - cranial cavity – contains the brain
   - vertebral or spinal cavity – contains the spinal cord
   - separated by the foramen magnum

2. **Ventral Cavity** is composed of two subdivisions. Houses internal organs.
   - thoracic cavity – contains lungs, heart, esophagus, trachea
   - thoracic cavity subdivisions -
     - Two pleural cavities - Each surrounds a lung
     - Mediastinum - Contains pericardial cavity; Surrounds thoracic organs
   - abdominopelvic cavity – is divided into the abdominal and pelvic cavity; contains digestive, urinary and reproductive structures
   - separated by the diaphragm
Membranes in the visceral body cavity:

- Serous membranes, or serosae, cover the inner walls of the ventral cavity and the outer surfaces of organs.
- The parietal serosa lines the body cavity walls, and is named for the specific cavities it is associated with.
- The visceral serosa covers the outer surfaces of organs, and is named for the specific organs it is associated with.
- Serous membranes secrete and are separated by a thin layer of lubrication fluid called serous fluid, which allows organs to slide without friction along cavity walls and between each other.
Abdominopelvic Regions and Quadrants:
The abdominopelvic cavity is large and contains many organs so it is helpful to divide it up into smaller areas for study. The quadrants are usually used by medical personnel. The nine divisions are primarily used by anatomist.

- Other body cavities – oral, digestive, nasal, orbital, middle ear and synovial