**CHAPTER 1: INTRODUCTION TO HUMAN ANATOMY AND PHYSIOLOGY**

**OBJECTIVES**

1. Define the terms *anatomy* and *physiology*, and explain their relationship using an example of a human structure with its corresponding function.

2. List, in order from least to most complex, the levels of structural organization, discuss the relationship between the levels, and name an example at each level.

1. Write an introductory sentence that lists the levels from least to most complex.
2. Starting with the least complex level, complete the following:
   1. name the level
   2. define the term
   3. provide an example
   4. discuss how the next level is achieved.

3. List the 11 organ systems of the human organism, name the major organs within each, and give a general function for each system.

4. Name and define the ten life processes that distinguish living from non-living things.

5. Specify the five environmental needs required for life.

6. Define the term *homeostasis*, and name the manner in which homeostatic mechanisms are regulated. Then provide an example of a homeostatic mechanism in humans, and explain it fully, by providing a diagram followed by a complete essay explanation.

7. Demonstrate what is meant by "anatomical position".

8. Define various directional terms (i.e. superior, inferior, etc.), and compare different body parts using these terms (i.e. the elbow is proximal to the wrist).

9. List both anterior and posterior anatomical landmarks (i.e. orbital, inguinal, etc.).

10. Name the three major body sections (planes, cuts), and describe how each would be accomplished.

11. Designate the five major human body cavities and name the organs within each on a human diagram.

12. Describe the anatomical importance of the *diaphragm* muscle.

13. Describe the nine regions of the abdominal area and the four quadrants of the abdominal area and list the major organs found within each.

14. Distinguish between visceral and parietal serous membranes, and differentiate between pericardial, pleural, and peritoneal varieties.

I. **INTRODUCTION**

* Study of anatomy and physiology is an ever-developing science.
* Greek and Latin form the basis for the language of anatomy and physiology.

II. **DEFINITIONS**: See Fig. 1.2, page 4.

1. **ANATOMY** = the study of the **structure** (morphology, form) of body parts.
2. **PHYSIOLOGY** = the study of the **function** of body parts.

III. **STRUCTURAL LEVELS OF ORGANIZATION**:

See Fig 1.3, page 5 and Table 1.1, page 5.

A. The **atom** [i.e. Carbon (C), Hydrogen (H), or Oxygen(O)] is the least complex level. An atom is defined as the smallest particle of an element. Atoms combine with (react with) other atoms to form...

B. **molecules** [i.e. carbon dioxide (CO2), water (H20)]. A molecule is defined as a particle composed of 2 or more joined atoms. Molecules combine with other molecules to form...

C. **macromolecules** (i.e. carbohydrates, lipids, proteins, nucleic acids). A macromolecule is defined as a large molecule. Macromolecules combine with other macromolecules to form...

D. **organelles** (i.e. cell membrane, nucleus, ribosomes). An organelle is defined as a small organ of a cell, which performs a particular function. Organelles collectively compose ...

E. **cells**. *The cell is defined as the basic unit of structure and function of living organisms!*

Each cell has a set of organelles and performs a particular function (i.e. a red blood cell has a biconcave shape and is a nucleate. This structure increases its surface area, allowing for the transport of more oxygen0.

***Some cells have all of the machinery that they need to live. See the amoeba a single-celled organism in Fig 1.4, page 9.***

Similar cells are arranged into...

F. **tissues** (i.e. epithelia, connective, muscle, nervous). A tissue is defined as a group of similar cells that performs a specialized function. Two or more tissues combine to form...

G. **organs** (i.e. skin, heart, brain). An organ is defined as a structure consisting of a group of tissues that performs a specialized function. Two or more organs combine to form...

H. **organ systems** (i.e. integumentary, cardiovascular). An organ system is defined as a group of organs that act together to carry on a specialized function. The eleven organ systems collectively form the...

I. **human organism.** An organism is the most complex level of organization and is defined as an individual living thing.

J. The levels of hierarchy could be further extended to include; **populations**, **communities, ecosystems**, and the **biosphere**.

IV. **CHARACTERISTICS OF LIFE**

A. Ten processes: See Table 1.3, page 8.

1. Movement
2. Responsiveness
3. Growth
4. Reproduction
5. Respiration
6. Digestion
7. Absorption
8. Circulation
9. Assimilation
10. Excretion

V. **MAINTANENCE OF LIFE**

A. Requirements of Organisms See Table 1.4, page 9.

1. nutrients for energy

2. oxygen for cellular respiration

3. water for most metabolic reactions, lubrication, etc.

4. heat to maintain 37oC body temp, enzyme action

5. pressure for breathing and filtering blood through kidneys

B. Homeostasis See Fig 1.7 and Fig 1.8, page 11.

1. Definition = the tendency of an organism to maintain **a stable internal environment**.

2. All life processes and metabolic reactions work to maintain homeostasis.

1. Most homeostatic mechanisms are regulated by **negative feedback** (see example below).
2. All homeostatic mechanisms have three components in common.
   1. Receptor – senses change in environment
   2. Control Center – Regulates set-point of variables
   3. Effector – organ that acts in response to changes

5. Example = maintenance of body temperature at 98.6oF/37oC.

VI**. ORGANIZATION OF THE HUMAN BODY**

A. Body CavitiesSee Fig 1.9, page 13.

# HUMAN BODY

AXIAL PORTION APPENDICULAR PORTION

head arms

neck legs

trunk

## MAJOR CAVITIES

## DORSAL CAVITY VENTRAL CAVITY

CRANIAL CAVITY THORACIC CAVITY

brain lungs

mediastinum

VERTEBRAL CANAL thymus

spinal cord heart

esophagus

trachea

\* **Note that the diaphragm muscle separates the thoracic from abdominopelvic cavities.**

ABDOMINOPELVIC CAVITY

*ABDOMINAL CAVITY PELVIC CAVITY*

stomach urinary bladder liver internal reproductive

spleen organs

gallbladder

small intestine

large intestine

\* Note that the kidneys, adrenal glands, pancreas, and ureters are behind the abdominopelvic cavity. This is referred to as RETROPERITONEAL.

VI. **ORGANIZATION OF THE HUMAN BODY**

B. **Thoracic and Abdominopelvic Membranes**

**1. Membrane** = a soft, thin, pliable layer of tissue that either:

a. covers a vital (visceral organ) = **VISCERAL MEMBRANE.**

b. lines a body cavity = **PARIETAL MEMBRANE.**

2. There is a space between a visceral and parietal membrane into which **SEROUS fluid** is secreted for **lubrication**.

3. There are specific names for the membranes around the heart, lungs, and abdominal organs:

a. Serous Membranes of the **LUNGS: See Fig 1.11, page 15.**

 The membrane on the **surface** of the lung is called **visceral pleura**.

 The membrane that **lines the cavity** in which the lungs are located is called **parietal pleura**.

 The space between these two membranes is called the **pleural cavity**, and it is filled with **serous fluid**.

b. Serous Membranes of the **HEART: See Fig 1.11, page 15.**

 The membrane on the **surface** of the heart is called **visceral pericardium**.

 The membrane that **lines the cavity** in which the heart is located is called **parietal pericardium**.

 The space between these two membranes is called the **pericardial cavity**, and it is filled with **serous fluid**.

c. Serous Membranes of the **ABDOMINAL ORGANS:**

**See Fig 1.12, page 15.**

 The membrane on the **surface** of the liver, stomach, etc. is called **visceral peritoneum**.

 The membrane that **lines the abdominal cavity** is called **parietal peritoneum**.

 The space between these two membranes is called the **peritoneal cavity**, and it is filled with **serous fluid**.

(Keyed at the end of this outline)

VI. **ORGANIZATION OF THE HUMAN BODY**

C. **Organ Systems:** Seepages 16-20 in textbook.

|  |  |  |  |
| --- | --- | --- | --- |
| **BASIC CLASSIFICATION** | **SYSTEM NAME** | **ORGANS IN SYSTEM** | **FUNCTION(S)** |
| Body coverings |  |  |  |
| Support and Movement |  |  |  |
|  |  |  |  |
| Integration and Coordination |  |  |  |
|  |  |  |  |
| Transport |  |  |  |
|  |  |  |  |
| Absorption and Secretion |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Reproduction |  |  |  |

##### ANATOMICAL TERMINOLOGY

A. Definition = a language used to describe the relative position of body parts; needed for **communication**.

B. **Anatomical Position** = standing erect, face forward, upper limbs at sides, palms forward.

C. **Relative Position**

1. Superior = above; Inferior = below;

2. Anterior = front; Posterior = back;

1. Ventral = front; Dorsal = back;
2. Medial = center; Lateral = side;
3. Ipsilateral = same side; Contralateral = other side

6. Proximal = closer to trunk; Distal = farther from trunk;

7. Superficial = surface; Deep = internal.

D. **Body Sections (cuts, planes**)

See Fig 1.20, page 22 and Figures 1.21, page 22 and 1.22, page 23

1. **Sagittal cut**: divides the body into right and left portions.

a. midsagittal (median) = equal right and left portions.

2. **Transverse Cut** (or horizontal): divides the body into superior and inferior portions

3. **Coronal Cut** (or frontal): divides the body into anterior and posterior portions.

1. Cross-section: cut at 90 degrees to long axis of the object

5. Oblique section: cut at an angle across an object

1. Longitudinal section: cut with the long axis of an object

VIII. **ANATOMICAL TERMINOLOGY** (Keyed at the end of this outline)

E. **Body Regions** See Fig 1.23a, page 23.

1. **Abdominal regions**

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |

2. **Abdominal Quadrants**: See Fig 1.23b, page 23.

|  |  |
| --- | --- |
|  |  |
|  |  |

VIII. **ANATOMICAL TERMINOLOGY**

F. **Surface Anatomy (Landmarks)**:

See Fig 1.24, page 24.

1. Anterior Landmarks:

|  |  |
| --- | --- |
| Above the Waist | Below the Waist |
| 1. cranial= skull | 1. femoral=thigh |
| 1. facial=face | 1. patellar=knee cap |
| 1. cephalic=head | 1. crural=leg |
| 1. cervical=neck | 1. coxal=hip |
| 1. axillary=armpit | 1. inguinal=groin |
| 1. brachial=upper arm | 1. pubic=pelvic |
| 1. antecubital=anterior elbow | aa. tarsal=ankle |
| 1. antebrachial=forearm |  |
| 1. carpal=wrist |  |
| 1. metacarpal=hand |  |
| 1. digital=finger |  |
| 1. frontal=forehead |  |
| 1. orbital=eye |  |
| 1. otic=ear |  |
| 1. buccal=cheek |  |
| 1. nasal=nose |  |
| 1. oral=mouth |  |
| 1. mental=chin |  |
| 1. mammary=breast |  |
| t. umbilical=naval |  |

2. Posterior Landmarks

|  |  |
| --- | --- |
| Above the Waist | Below the Waist |
| 1. acromial=shoulder | e. gluteal=buttocks |
| b. cubital=elbow | f. popliteal=back of knee |
| c. lumbar=loin | g. pedal=foot |
| d. dorsal=back | h. plantar=sole |
|  | i. calcaneal=heel |
|  |  |

1. **SOME MEDICAL AND APPLIED SCIENCES** – see page 25.
2. **THE HUMAN ORGANISM** – see pages 30-36.

###### Organ Systems

|  |  |  |  |
| --- | --- | --- | --- |
| **BASIC CLASSIFICATION** | **SYSTEM NAME** | **ORGANS IN SYSTEM** | **FUNCTION(S)** |
| Body coverings | **INTEGUMENTARY** | Skin, hair, nails, sweat glands, sebaceous glands | protection, regulation of body temperature, synthesis of Vitamin D, etc. |
| Support and Movement | **SKELETAL** | Bones, tendons, ligaments, cartilages | support, protection, movement, Ca++ store, hematopoiesis |
|  | **MUSCULAR** | Skeletal Muscles | movement, heat production |
| Integration and Coordination | **NERVOUS** | Brain, spinal cord, nerves | coordination of body parts; information processing |
|  | **ENDOCRINE** | Endocrine Glands that secrete hormones | maintenance of homeostasis |
| Transport | **CARDIOVASCULAR** | Heart, blood vessels | Electrolyte maintenance, transport of nutrients, wastes, O2 and CO2 |
|  | **LYMPHATIC** | Bone marrow, lymph nodes, thymus, spleen | to fight infection |
| Absorption and Secretion | **RESPIRATORY** | oral cavity, nose, nasal cavity, sinuses, pharynx, larynx, trachea, bronchial tubes within lungs, alveoli | exchange of gases (O2 and CO2), maintenance of blood pH and electrolytes; voice production |
|  | **URINARY** | kidneys, ureters, urinary bladder, urethra | removal of metabolic wastes from blood, maintenance of blood (i.e. pH, pressure, etc.), maintenance of electrolytes |
|  | **DIGESTIVE** | Oral cavity, pharynx, esophagus, stomach, small and large intestine, salivary glands, liver, pancreas, gall bladder | breakdown of food into substances that can be absorbed (for energy) |
| Reproduction | **REPRODUCTIVE** | male: testes, epididymis, vas deferens, prostate, seminal vesicle, bulbourethral glands, urethra, penis, scrotum  female: ovaries, fallopian tubes, uterus, cervix, vagina, labia, clitoris | production, maintenance and transport of gametes; production of sex hormones  Female: house developing embryo/fetus |

**Abdominopelvic Areas**

Nine Regions

|  |  |  |
| --- | --- | --- |
| **RIGHT HYPOCHONDRIAC REGION** | **EPIGASTRIC**  **REGION** | **LEFT HYPOCHONDRIAC REGION** |
| **RIGHT LUMBAR REGION** | **UMBILICAL**  **REGION** | **LEFT LUMBAR**  **REGION** |
| **RIGHT ILIAC**  **REGION** | **HYPOGASTRIC**  **REGION** | **LEFT ILIAC**  **REGION** |

**Four Quadrants**:

|  |  |
| --- | --- |
| **RIGHT UPPER**  QUADRANT | **LEFT UPPER**  QUADRANT |
| **RIGHT LOWER**  QUADRANT | **LEFT LOWER**  QUADRANT |