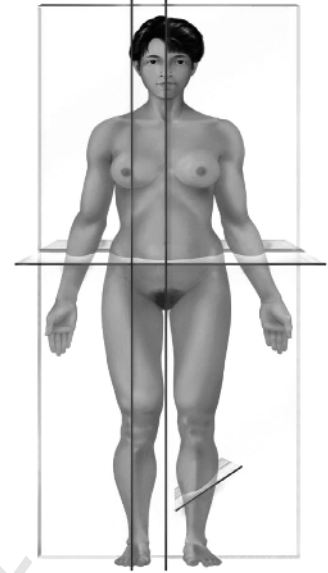


# 1 An Introduction to the Human Body



Anatomy is the science of body structures and their relationships. Physiology is the science of body functions.

## **Concept 1.1 The human body is composed of six levels of structural organization and contains eleven systems.**

The six structural levels of body organization from smallest to largest are chemical, cellular, tissue, organ, system, and organismal. The chemical level includes atoms and molecules. The cellular level occurs when molecules build cells, the basic units of structure and function in living organisms.

Groups of cells unite to form the tissue level composed of four basic types of tissues: epithelial, connective, muscle, and nervous. Different tissues join together to form the organ level. Different organs join together to form the system level. All the systems form the largest level, the organismal level. An organism is a living individual. There are eleven body systems in the human body.

## **Concept 1.2 The human body carries on basic life processes that distinguish it from nonliving objects.**

All living organisms undergo chemical processes referred to as metabolism, including catabolism, the breaking down of large chemical compounds to smaller ones, and anabolism, the building of large compounds from smaller ones. Living organisms respond to changes in their environment (a characteristic called responsiveness), and they exhibit movement of the whole body or structures within the body.

Growth, an increase in body size, and differentiation, such as that of stem cells into specialized cells, are two additional basic life processes. Living organisms undergo reproduction to form new cells for tissue growth or for production of a new individual.

Homeostasis is the maintenance of relatively stable internal body conditions despite changes that occur inside and outside the body. Homeostasis maintains the volume and composition of body fluids inside and outside of cells.

The fluid inside cells is intracellular fluid, and the fluid outside of cells is extracellular fluid. Interstitial fluid, blood plasma, lymph, cerebrospinal fluid, and synovial fluid are extracellular fluids.

### **Concept 1.3 Homeostasis is controlled through feedback systems.**

The body is continually confronted with internal and external stresses. The principal regulatory systems, the nervous system and endocrine system, work to provide corrective measures to achieve homeostasis and restore balance to the body's internal environment.

A feedback system is a cycle of events that monitor, evaluate, and change disruptions to a controlled condition in the body. Three components comprise a feedback system: a receptor, a control center, and an effector. A receptor monitors changes and sends input to a control center, where input is evaluated and output commands are sent to effectors that produce a response. Responses that reverse the original stimulus involve negative feedback. Responses that intensify the original stimulus involve positive feedback.

The inability of one or more body components to contribute to homeostasis may result in disease or death. A disorder is an abnormality of structure and/or function. A disease refers to an illness accompanied by a set of clinically observable, measurable changes called signs, and subjective changes experienced by the patient referred to as symptoms.

### **Concept 1.4 The human body is described using the anatomical position and specific terms.**

In the anatomical position, the body is erect, facing forward, head level, eyes forward, feet flat and forward, and arms at the sides with palms forward. The body is in the prone position when lying face down, and in the supine position when lying face up. The human body is divided into several major regions identified externally. These are the head, skull, face, neck, trunk, upper limbs, and lower limbs.

In order to describe the position of one body part relative to another body part, specific directional terms must be used. The body and body parts can be cut along imaginary flat surfaces referred to as planes. A sagittal plane divides the body or organ into right and left sections. When the plane passes directly through the midline resulting in equal right and left sides, it is a midsagittal (median) plane. A parasagittal plane results in unequal right and left sides.

A frontal (coronal) plane divides the body or organ into front and back sections. A transverse (horizontal) plane results in upper and lower sections. An oblique plane passes through the body or organ at an angle. Body regions are often studied in sections. A section is one flat surface of the three-dimensional structure or cut along a plane for which is it named.

### **Concept 1.5 Body cavities are spaces within the body that help protect, separate, and support internal organs.**

Body cavities are separated from one another by bones, muscles, and ligaments. The cranial cavity houses the brain, and the vertebral canal contains the spinal cord. The diaphragm separates the superior thoracic cavity and the inferior abdominopelvic cavity.

The thoracic cavity houses three smaller cavities: the pericardial cavity, around the heart; and two pleural cavities, each surrounding a lung. Located between the lungs, extending from the neck to the diaphragm, is the mediastinum, which contains all thoracic viscera except the lungs.

The abdominopelvic cavity has a superior region, the abdominal cavity, containing the stomach, spleen, liver, gallbladder, small intestine, and most of the large intestine. The inferior region, the pelvic cavity, contains the urinary bladder, portions of the large intestine, and reproductive organs.

### **Concept 1.6 Serous membranes line the walls of body cavities and cover the organs within them.**

The thoracic and abdominal cavity walls and viscera are covered with a thin, slippery **serous membrane**. The part of the serous membrane that lines cavity walls is the parietal layer, and the visceral layer covers the organs within the cavity. The pleura, pericardium, and peritoneum are serous membranes.

The **pleura** is the serous membrane of the pleural cavities around the lungs; the **pericardium** is the serous membrane of the pericardial cavity around the heart; and the **peritoneum** is the serous membrane of the abdominal cavity around abdominal viscera. Organs such as the kidneys that are located posterior to the parietal peritoneum are referred to as retroperitoneal.

### **Concept 1.7 The abdominopelvic cavity is divided into regions or quadrants.**

Anatomists and clinicians use two methods of dividing the abdominopelvic cavity into smaller areas in order to describe the location of organs. One method divides the cavity into **abdominopelvic regions: right hypochondriac, epigastric, left hypochondriac, right lumbar, umbilical, left lumbar, right inguinal, hypogastric and left inguinal**.

The other method divides the cavity into **quadrants: right upper quadrant, left upper quadrant, right lower quadrant, and left lower quadrant**.



# The Language of Science and Medicine

*“Why do scientists seem to speak a foreign language (in any language)?”*

## Model 1: Common Root Words and Their Meaning

Root word	Meaning	Example	Example Definition
arthr-	Joint	Arthritis	Inflammation of a joint
brachi-	Arm	Brachial	Having to do with the arm
card-	Heart	Endocarditis	Inflammation of the heart lining
cerv-	Neck	Cervical cancer	Cancer of the neck of the uterus
cyt-	Cell	Cytology	The study of cells
dactyl-	Fingers/toes	Polydactyly	Having too many fingers or toes
derm-	Skin	Dermatologist	Physician who specializes in the skin
gastr-	Stomach	Gastrin	Hormone secreted into stomach
hepat-	Liver	Hepatocyte	Liver cell
hydro-	Water	Hydrophobic	Water fearing
kal-	Potassium	Hypokalemia	Not enough potassium in the blood
my-, myo-	Muscle	Myalgia	Muscle pain
nephro-	Kidney	Nephropathy	Kidney disease
neur-	Nerve	Neuralgia	Nerve pain
onco-	Cancer	Oncologist	A physician who specializes in cancer
sept-	Contamination	Septicemia	Contamination in the blood
vas-	Vessel	Vasodilation	Enlargement of a blood vessel
natr-	Sodium	Natriuretic	Causing the excretion of sodium

## Critical Thinking Questions

1. What root word is used to indicate something that has to do with water?
2. What roots could you use to describe a structure associated with muscle?
3. Someone who has neuritis is having problems with what structure(s)?
4. Vertebrae are the bones of the spine. Where are your cervical vertebrae?

## Application

5. Based on the model above, your group should devise a short, grammatically correct, English sentence that defines the word cardiomyocyte. Be prepared to share your definition with the class.
  
6. What suffix do arthritis and endocarditis have in common?
  - a. Based on this observation, what does your group think the suffix – itis means?
  
  - b. Likewise, what does –emia probably mean based on the examples in the model?
  
7. Write brief descriptions (like in the model) of the following words:
  - a. Hyponatremia:
  
  
  - b. Dermatitis:

## Model 2: Common Prefixes and Their Meaning

Prefix	Meaning	Example	Example Definition
a-	Without, not	Amenorrhea	Cessation of menstruation
dys-	Bad, wrong	Dysplasia	Problem with growth, malformation
ex-, exo-	Out of, out from	Exocytosis	To secrete from a cell
hem-, hemat-	Blood	Hemophilia	lit. "Love of bleeding", inability to clot
hyper-	Above, over	Hyperkalemia	Too much potassium in the blood
hypo-	Below, under	Hypothermia	Below optimal body temperature
para-	Near, next to	Paracrine	Secretions that target nearby tissues
quadri-	Four of	Quadriceps	Muscle with four parts

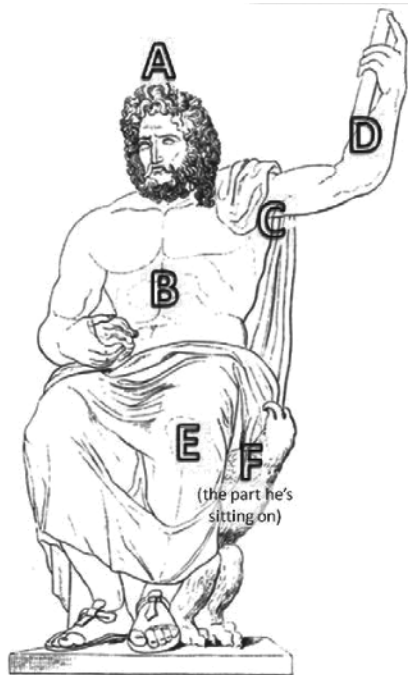
### Critical Thinking Questions

8. Based on the model, what does the prefix a- indicate?
9. If a physician tells you that *Staphylococcus aureus* can cause an asymptomatic infection, what effect will that infection have on a patient?
10. Based solely on the model, where could you expect to find your parathyroid glands?

### Application

11. As a group, estimate the body temperature of someone suffering from hyperthermia. Be able to justify your answer.
12. The root word "glycol" means sugar. Based on this definition and the two prior models, write a definition below for the term hyperglycemia.
13. You are a nurse in an obstetrics practice. A young couple has just been told that their child will be born suffering from adactyly. How would you explain this to them?

## Model 3: Zeus



von Wilhelm. Zeus, Dr. Vollmer's  
Wörterbuch der Mythologie aller Völker,  
3rd Edition Stuttgart 1874, Public Domain.

### Critical Thinking Questions

14. Use whatever words you like (above, in front of, top, etc) to describe the relative positions of the labeled areas indicated below:

- a. A relative to B
- b. C relative to B
- c. D relative to C
- d. E relative to B
- e. F relative to B

When you have finished with Parts a-e, send your group's reporter to another group and compare answers. Make a note of how many answers are exactly the same.

15. Now look at Model 4 on the next page. Using Model 4 as a guideline, answer Questions a-e again in the space below.

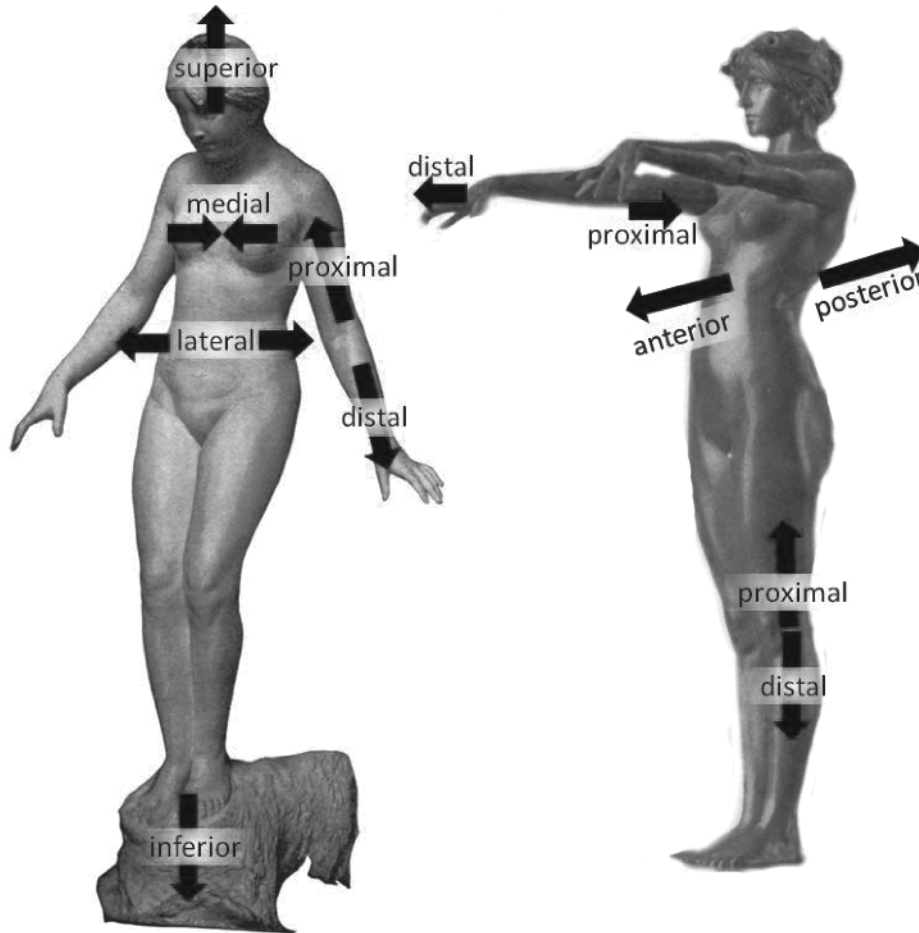
- a. A relative to B
- b. C relative to B
- c. D relative to C
- d. E relative to B
- e. F relative to B

When you have finished with Parts a-e, send your group's reporter to another group and compare answers. Make a note of how many answers are exactly the same.

Is this more or less than the last time?



## Model 4: Directions of the Body



Bertram Mackennal, Edward. Circe: Statue, Public Domain.

16. We have learned quite a few specific medical/anatomical terms today. Take a few minutes and discuss in your group whether or not you see any value in having such specific terms in science and medicine. The scribe should summarize your discussion in the space below, the presenter should be able to defend your answers.

## Exercises

Use the “<http://www.globalrph.com/medterm.htm>” to answer the following questions.

1. Define these terms just using the words parts in your guide. Don't look them up in a glossary or online, that will totally defeat the purpose of this activity.
  - a. adipsia
  - b. hepatitis
  - c. hypernatremia
  - d. renomedullary
  - e. histocytosis
  - f. polyphagia
2. Create a scientific term to describe the following:
  - a. Creation of tissues
  - b. White cell
  - c. To cut the trachea
  - d. Pain in the eyes
3. Fill in the blanks below using the proper directional terms from Model 4 of this exercise.
  - a. The elbow is \_\_\_\_\_ to the wrist.
  - b. The breastbone is \_\_\_\_\_ to the spine.
  - c. The nose is \_\_\_\_\_ to the cheeks.
  - d. The ears are on the \_\_\_\_\_ aspect of the head.
  - e. The ankle joint is \_\_\_\_\_ to the knee joint.
  - f. The kneecap is on the \_\_\_\_\_ surface of the knee.