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Introduction

This appendix discusses selected aspects of **biophysics**, the study of physics as it applies to biological systems. Because living systems are in a continual exchange of force and energy, it is necessary to define these important concepts. According to the seventeenth-century scientist Sir Isaac Newton, a body at rest tends to stay at rest, and a body in motion tends to continue moving in a straight line unless the body is acted upon by some force (Newton's First Law).

Newton further defined **force** as an influence, measurable in both intensity and direction, that operates on a body in such a manner as to produce an alteration of its state of rest or motion. Put another way, force gives **energy** to a quantity, or mass, thereby enabling it to do work. In general, a driving force multiplied by a quantity yields energy, or work. For example:

$$\text{force} \times \text{distance} = \text{work}$$

Energy exists in two general forms: kinetic energy and potential energy. **Kinetic energy** {*kinein*, to move} is the energy possessed by a mass in motion. **Potential energy** is energy possessed by a mass because of its position. Kinetic energy (*KE*) is equal to one-half the mass (*m*) of a body in motion multiplied by the square of the velocity (*v*) of the body:

$$KE = \frac{1}{2} mv^2$$

Potential energy (*PE*) is equal to the mass (*m*) of a body multiplied by acceleration due to gravity (*g*) times the height (*h*) of the body above the earth's surface:

$$PE = mgh \quad \text{where } g = 10 \text{ m/s}^2$$

Both kinetic and potential energy are measured in joules.

Basic Units of Measurement

For physical concepts to be useful in scientific endeavors, they must be measurable and should be expressed in standard units of measurement. Some fundamental units of measure include the following:

Length (*l*): Length is measured in meters (m).

Time (*t*): Time is measured in seconds (s).

Mass (*m*): Mass is measured in kilograms (kg), and is defined as the weight of a body in a gravitational field.

Temperature (*T*): Absolute temperature is measured on the Kelvin (K) scale,

$$\text{where } K = \text{degrees Celsius } (^{\circ}\text{C}) + 273.15$$

$$\text{and } ^{\circ}\text{C} = (\text{degrees Fahrenheit} - 32) / 1.8$$

Electric current (*I*): Electric current is measured in amperes (A).

Amount of substance (*n*): The amount of a substance is measured in moles (mol).

Using these fundamental units of measure, we can now establish standard units for physical concepts (● Tbl. B.1). Although these are the standard units for these concepts at this time, they are not the only units ever used to describe them. For instance, force can also be measured in dynes, energy can be measured in calories, pressure can be measured in torr or mm Hg, and power can be measured in horsepower. However, all of these units can be converted into a standard unit counterpart, and vice versa.

The remainder of this appendix discusses some biologically relevant applications of physical concepts. This discussion includes topics such as bioelectrical principles, osmotic principles, and behaviors of gases and liquids relevant to living organisms.

Bioelectrical Principles

Living systems are composed of different molecules, many of which exist in a charged state. Cells are filled with charged particles such as proteins and organic acids, and ions are in continual flux across the cell membrane. Therefore, electrical forces are important to life.

When molecules gain or lose electrons, they develop positive or negative charges. A basic principle of electricity is that opposite charges attract and like charges repel. A force must act on a charged particle (a mass) to bring about changes in its position.

Standard Units for Physical Concepts

Table B-1

Measured Concept	Standard (SI*) Unit	Mathematical Derivation/Definition
Force	Newton (N)	1 N = 1 kg · m/s ²
Energy/Work/Heat	Joule (J)	1 J = 1 N · m
Power	Watt (W)	1 W = 1 J/s
Electrical charge	Coulomb (C)	1 C = 1 A · s
Potential	Volt (V)	1 V = 1 J/C
Resistance	Ohm (Ω)	1 Ω = 1 V/A
Capacitance	Farad (F)	1 F = 1 C/V
Pressure	Pascal (Pa)	1 Pa = 1 N/m ²

* SI = Système International d'Unités

Therefore, there must be a force acting on charged particles to cause attraction or repulsion, and this electrical force can be measured.

Electrical force increases as the strength (number) of charges increases, and it decreases as the distance between the charges increases (● Fig. B.1). This observation has been called **Coulomb's law**, and can be written:

$$F = q_1q_2/\epsilon d^2$$

where q_1 and q_2 are the electrical charges (coulombs), d is the distance between the charges (meters), ϵ is the dielectric constant, and F is the force of attraction or repulsion, depending on the type of charge on the particles.

When opposite charges are separated, a force acts over a distance to draw them together. As the charges move together, work is being done by the charged particles and energy is being released. Conversely, to separate the united charges, energy must be added and work done. If charges are separated and kept apart, they have the potential to do work. This electrical potential is called **voltage**. Voltage is measured in **volts (V)**.

If electrical charges are separated and there is a potential difference between them, then the force between the charges allows electrons to flow. Electron flow is called an electric **current**. The

Faraday constant (F) is an expression of the electrical charge carried by one mole of electrons and is equal to 96,485 coulombs/mole.

The amount of current that flows depends on the nature of the material between the charges. If a material hinders electron flow, then it is said to offer **resistance (R)**, measured in ohms. Current is inversely proportional to resistance, such that current decreases as resistance increases. If a material offers high resistance to electron flow, then that material is called an **insulator**. If resistance is low, and current flows relatively freely, then the material is called a **conductor**. Current, voltage, and resistance are related by **Ohm's law**, which states:

$$V = IR$$

where V = potential difference in volts
 I = current in amperes
 R = resistance in ohms

In biological systems, pure water is not a good conductor, but water containing dissolved NaCl is a good conductor because ions provide charges to carry the current. In biological membranes, the lipids have few or no charged groups, so they offer high resistance to current flow across them. Thus, different cells can have different electrical properties depending on their membrane lipid composition and the permeability of their membranes to ions.

ELECTRICAL FORCE

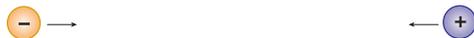
If you separate two opposite charges, there will be an electric force between them.



If you increase the number of charges that are separated, the force increases.



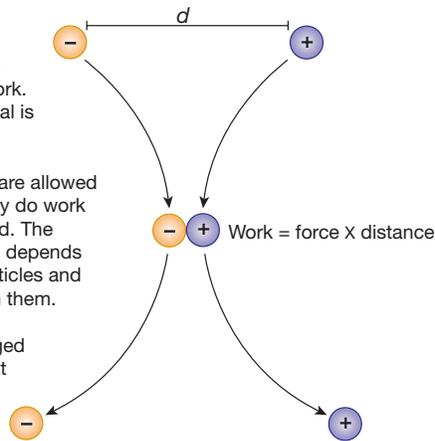
If you increase the distance between the charges, the force decreases.



If charges are separated by some distance d , they have the potential to do work. This electrical potential is called voltage.

If separated charges are allowed to move together, they do work and energy is released. The amount of work done depends on the number of particles and the distance between them.

To separate the charged particles, energy must be put into the system and work is done.



● Fig. B-1

Osmotic Principles

Freezing point, vapor pressure, boiling point, and osmotic pressure are properties of solutions collectively called **colligative properties**. These properties depend on the number of solute particles present in a solution. **Osmotic pressure** is the force that drives the diffusion of water across a membrane. Because there are no solutes in pure water, it has no osmotic pressure. However, if one adds a solute like NaCl, the greater the concentration (c) of a solute dissolved in water, the greater the osmotic pressure. The osmotic pressure (π) varies directly with the concentration of solute (number of particles (n) per volume (V)):

$$\pi = (n/V)RT$$

$$\pi = cRT$$

where R is the ideal gas constant (8.3145 joules/ $K \cdot mol$) and T is the absolute temperature in Kelvin. Osmotic pressure can be measured by determining the mechanical pressure that must be applied to a solution so that osmosis ceases.

Water balance in the body is under the control of osmotic pressure gradients (concentration gradients). Most cell membranes allow water to pass freely, primarily through open channels. To control the movement of water, the body either removes these channels from the membrane or control solute movement that creates concentration gradients.

Relevant Behaviors of Gases and Liquids

The respiratory and circulatory systems of the human body obey the physical laws that govern the behavior of gases and liquids. This section discusses some of the important laws that govern these behaviors and how our body systems utilize these laws.

Gases

The **ideal gas law** states:

$$PV = nRT$$

where P = pressure of gases in the system

V = volume of the system

n = number of moles in gas

T = temperature

R = ideal gas constant (8.3145 J/K mol)

If n and T are kept constant for all pressures and volumes in a system of gases, then any two pressures and volumes in that system are related by Boyle's Law,

$$P_1V_1 = P_2V_2$$

where P represents pressure and V represents volume.

This principle is relevant to the human lungs because the concentration of gas in the lungs is relatively equal to that in the atmosphere. In addition, body temperature is maintained at a constant temperature by homeostatic mechanisms. Therefore, if the volume of the lungs is changed, then the pressure in the lungs changes inversely. For example, an increase in pressure causes a decrease in volume, and vice versa.

Liquids

Fluid pressure (or hydrostatic pressure) is the pressure exerted by a fluid on a real or hypothetical body. In other words, the pressure exists whether or not there is a body submerged in the fluid. Fluid exerts a pressure (P) on an object submerged in it at a certain depth from the surface (h). **Pascal's law** allows us to find the fluid pressure at a specified depth for any given fluid. It states:

$$P = \rho gh$$

where P = fluid pressure (measured in pascals, Pa)

ρ = density of the fluid

g = acceleration due to gravity (10 m/s²)

h = depth below the surface of the fluid

Fluid pressure is unrelated to the shape of the container in which the fluid is situated.

Review of Logarithms

Understanding logarithms ("logs") is important in biology because of the definition of pH:

$$\text{pH} = -\log_{10} [\text{H}^+]$$

This equation is read as "pH is equal to the negative log of the hydrogen ion concentration." But what is a logarithm?

A logarithm is the exponent to which you would have to raise the base (10) to get the number in which you are interested. For example, to get the number 100, you would have to square the base (10):

$$10^2 = 100$$

The base 10 was raised to the second power; therefore, the log of 100 is 2:

$$\log 100 = 2$$

Some other simple examples include:

$$10^1 = 10 \quad \text{The log of 10 is 1.}$$

$$10^0 = 1 \quad \text{The log of 1 is 0.}$$

$$10^{-1} = 0.1 \quad \text{The log of 0.1 is } -1.$$

What about numbers that fall between the powers of 10? If the log of 10 is 1 and the log of 100 is 2, the log of 70 would be between 1 and 2. The actual value can be looked up on a log table or ascertained with most calculators.

To calculate pH, you need to know another rule of logs that says:

$$-\log x = \log (1/x)$$

and a rule of exponents that says:

$$1/10^x = 10^{-x}$$

Suppose you have a solution whose hydrogen ion concentration $[\text{H}^+]$ is 10^{-7} mEq/L. What is the pH of this solution?

$$\text{pH} = -\log [\text{H}^+]$$

$$\text{pH} = -\log [10^{-7}]$$

Using the rule of logs, this can be rewritten as

$$\text{pH} = \log (1/10^{-7})$$

Using the rule of exponents, this can be rewritten as

$$\text{pH} = \log 10^7$$

The log of 10^7 is 7, so the solution has a pH of 7.

Natural logarithms (ln) are logs in the base e . The mathematical constant e is approximately equal to 2.7183.

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What is DNA?

Deoxyribonucleic acid (DNA) is the macromolecule that stores all information a cell needs to survive and reproduce. DNA and its cousin RNA belong to a group of macromolecules called **nucleic acids**. Nucleic acids are polymers made from monomers {*mono-*, one} called **nucleotides**. Each nucleotide consists of a *nucleoside* (a pentose, or 5-carbon, sugar covalently bound to a nitrogenous base) and a phosphoric acid with at least one phosphate group.

In humans, many millions of nucleotides join together to form a DNA molecule. Eukaryotic DNA is commonly in the form of a double helix that looks like a twisted ladder or twisted zipper. The two sugar-phosphate sides, or backbones, are the same for every DNA molecule, but the sequence of the nucleotides is unique for each individual organism.

Functions of DNA

Cells use the information stored in DNA to build their structural and functional components. DNA also provides the basis for inheritance when DNA is passed from parent to offspring. The union of these concepts about DNA allows us to devise a working definition of a gene. A **gene** is a segment of DNA that codes for the synthesis messenger RNA (mRNA) to make proteins. Genes also act as a unit of inheritance that can be transmitted from generation to generation. The external appearance (**phenotype**) of an organism is determined to a large extent by the genes it inherits (**genotype**). Thus, one can begin to see how variation at the DNA level can cause variation at the level of the entire organism. These concepts form the basis of **genetics** and evolutionary theory.

DNA's primary function in most cells is to initiate the synthesis of proteins needed for cell structure or function. The information coded in DNA is first *transcribed* into mRNA. mRNA leaves the cell nucleus and enters the cytoplasm, where its code is *translated* into proteins. The second key function of DNA is its ability act as a unit of inheritance when transmitted across generations.

Before we discuss DNA as a unit of inheritance, let's explain a few terms you need to know. A **chromosome** is one complete molecule of DNA. Each chromosome contains many DNA sequences that act as genes. Every gene comes in variants called **alleles**. Interactions between the cell products of alleles determine how that gene will be expressed in the phenotype of an individual.

Somatic cells {*soma*, body} are those cells that make up the majority of the body (e.g., a skin cell, a liver cell); they are not directly involved with passing on genetic information to future generations. Each somatic cell in a human contains two alleles of each gene, one allele inherited from each parent. For this reason, human somatic cells are called **diploid** ("two chromosome

sets"), meaning that they have two complete sets of all their chromosomes.

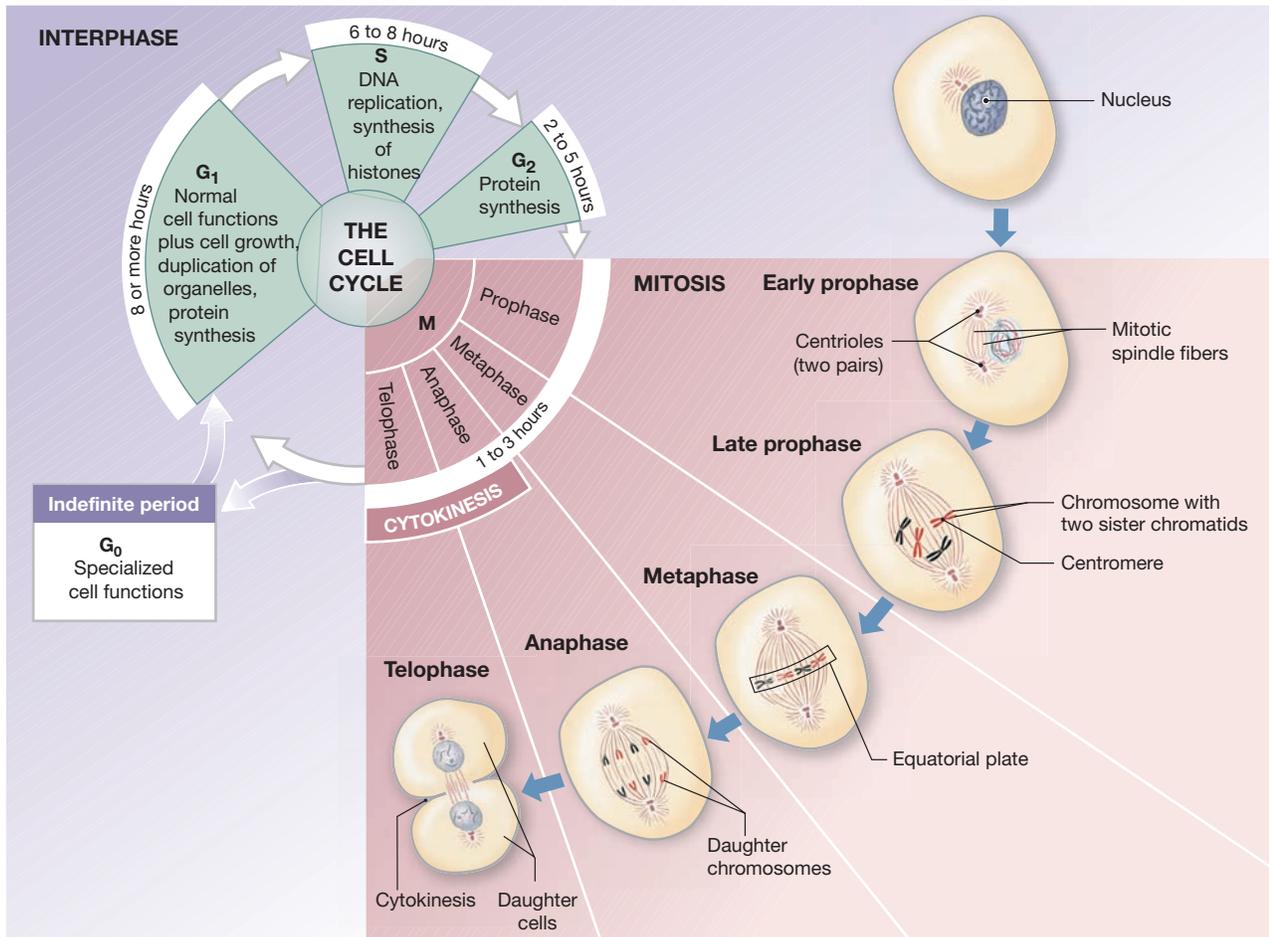
In contrast, **germ cells** pass genetic information directly to the next generation. In human males, the germ cells are the **spermatozoa** (sperm), and in human females, the germ cells are the **oocytes** (eggs). Human germ cells are called **haploid** ("half of the chromosome sets") because each germ cell only contains one chromosome set, which is equal to half of the chromosomes in somatic cells. When a human male germ cell joins with a human female germ cell, the result is a fertilized egg (zygote) containing the diploid number of chromosomes. If this zygote eventually develops into a healthy adult, that adult will have diploid somatic cells and haploid germ cells.

Cell Division

Cells alternate between periods of cell growth and cell division. There are two types of cell division: mitosis and meiosis. **Mitosis** is cell division by somatic cells that results in two daughter cells identical to the parent cell. Each daughter cell has a diploid set of chromosomes. **Meiosis**, in contrast, is cell division that results in four daughter cells, each with a haploid set of chromosomes. After meiosis, the daughter cells develop into germ cells, or eggs and sperm.

Cells that are not dividing are said to be in **interphase**. Interphase is divided into three stages: **G₁**, a period of cell growth, protein synthesis, and organelle production; **S**, the period during which DNA is replicated in preparation for cell division; and **G₂**, a period of protein synthesis and final preparations for cell division (● Fig. C.1). During interphase, the DNA in the nucleus is not visible under the light microscope without dyes because it is uncoiled and diffuse. However, as a cell prepares for division, it condenses all its DNA to form more manageable packages. Each eukaryotic DNA molecule has millions of nucleotides which, if laid end-to-end, could stretch out to about 6 cm. If this DNA molecule did not coil tightly and condense for cell division, imagine how difficult moving it around during cell division would be.

There is a hierarchy of DNA packaging in the cell (● Fig. C.2a). Each chromosome begins with a linear molecule of DNA about 2 nm in diameter. Then proteins called **histones** associate with the DNA to form **nucleosomes**, which consist of histones wrapped in DNA. A series of nucleosomes creates a fiber about 10 nm in diameter that looks like "beads on a string." The beaded string can twist into a **chromatin** fiber about 30 nm in diameter, with about 6 nucleosomes per turn. When cells get ready to divide, their chromatin fibers then coil even more to form the **chromosome fiber** (about 700 nm in diameter). Once DNA is in this state of condensed packaging, the cell is ready for division.



● Fig. C.1

Mitosis Creates Two Identical Daughter Cells

As stated earlier, mitosis is the division of a somatic cell that results in two diploid daughter cells. The DNA of the parent cell first duplicates itself into two complete sets of chromosomes. One set of chromosomes then goes to each daughter cell, and the daughter cells separate.

The four main steps of mitosis are **prophase**, **metaphase**, **anaphase**, and **telophase** (Fig. C.1). The entire somatic cell cycle can be remembered by the acronym, IPMAT, in which the “I” stands for interphase and the other letters stand for the steps of mitosis that follow.

Prophase

During prophase, chromatin becomes condensed and microscopically visible as duplicate chromosomes. The duplicated chromosomes form **sister chromatids**, which are joined to each other at the **centromere**. The cell’s centriole pair duplicates and the two centriole pairs move to opposing ends of the cell. The **mitotic spindle**, composed of microtubules, assembles between the centriole pairs. The nuclear membrane begins to break down and disappears by the end of prophase.

Metaphase

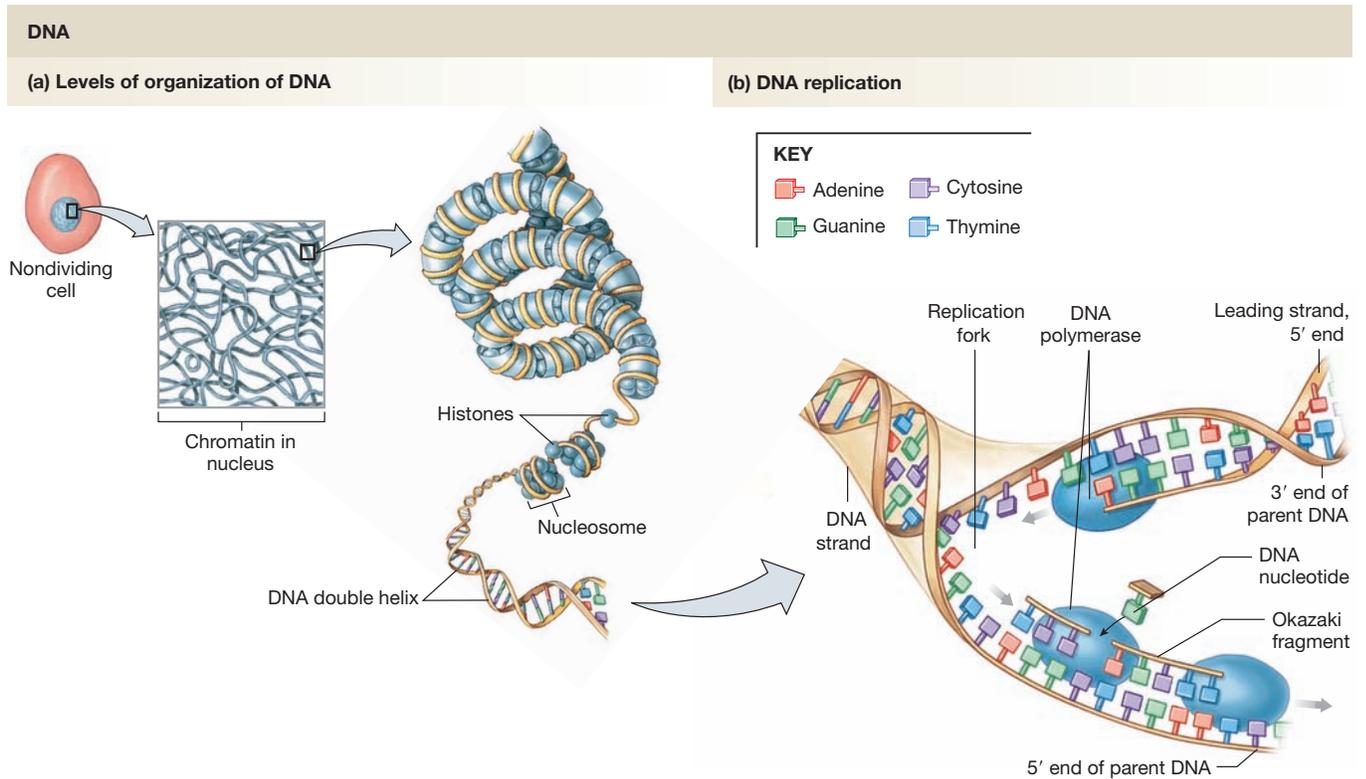
In metaphase, mitotic spindle fibers extending from the centrioles attach to the centromere of each chromosome. The 46 chromosomes, each consisting of a pair of sister chromatids, line up at the “equator” of the cell.

Anaphase

During anaphase, the spindle fibers pull the sister chromatids apart, so that an identical copy of each chromosome moves toward each pole of the cell. By the end of anaphase, an identical set of 46 chromosomes is present at each pole. At this point, the cell has a total of 92 chromosomes, double the diploid number.

Telophase

The actual division of the parent cell into two daughter cells takes place during telophase. In **cytokinesis**, the cytoplasm divides when an actin contractile ring tightens at the midline of the cell. The result is two separate daughter cells, each with a full diploid set of chromosomes. The spindle fibers disintegrate, nuclear envelopes form around the chromosomes in each cell, and the chromatin returns to its loosely coiled state.



● Fig. C.2

DNA Replication

The information stored in DNA is encoded in the nucleotide sequence of the molecule. When nucleotides link together, the phosphate group of one nucleotide bonds covalently to the sugar group of the adjacent nucleotide. The end of the polymer that has an unbound sugar is called the 3' ("three prime") end. The end of the polymer with the unbound phosphate is called the 5' end. A DNA molecule has four types of nucleotides, distinguished by their nitrogenous bases.

The nitrogenous bases in nucleic acids are classified as either **purines** or **pyrimidines**. The purine bases are **guanine (G)** and **adenine (A)**. The pyrimidine bases are **cytosine (C)**, and either **thymine (T)**, found in DNA only, or **uracil (U)**, found in RNA only. To remember which DNA bases are pyrimidines, look at the first syllable. The word "pyrimidine" and names of the DNA pyrimidine bases all have a "y" in the first syllable.

The "rungs" of the DNA double helix are created when the nitrogenous bases on one DNA strand form hydrogen bonds with nitrogenous bases on the adjoining DNA strand. This phenomenon is called **base-pairing**. The base-pairing rules are as follows:

- 1 Purines pair only with pyrimidines.
- 2 Guanine (G) bonds with cytosine (C) in both DNA and RNA.
- 3 Adenine (A) bonds with thymine (T) in DNA or with uracil (U) in RNA.

The two strands of DNA are bound in **antiparallel** orientation, so that the 3' end of one strand is bound to the 5' end of the second strand. This organization has important implications for DNA replication.

DNA Replication Is Semi-Conservative

To be transmitted from one generation to the next, DNA must be replicated. Furthermore, the process of replication must be accurate and fast enough for a living system. The base-pairing rules for nitrogenous bases provide a means for making an appropriate replication system.

In DNA replication, special proteins unzip the DNA double helix and build new DNA by pairing new nucleotide molecules to the two existing DNA strands. The result of this replication is two double-stranded DNA molecules, such that each DNA molecule contains one DNA strand from the template and one newly synthesized DNA strand. This form of replication is called **semi-conservative replication**.

Replication of DNA is bidirectional. A portion of DNA that is "unzipped" and has enzymes performing replication is called a **replication fork** (Fig. C.2b). Replication begins at many points (**origins of replication**), and it continues along both parent strands simultaneously until all the replication forks join.

Nucleotides bond together to form new strands of DNA with the help of an enzyme called **DNA polymerase**. DNA polymerase can add nucleotides only to the 3' end of a growing strand

of DNA. For this reason, DNA is said to replicate in a 5' to 3' direction.

The antiparallel orientation of the DNA strands and the directionality of DNA polymerase force replication into two different modes: **leading strand replication** and **lagging strand replication**. The DNA polymerase can replicate continuously along only one parent strand of DNA: the parent strand in the 3' to 5' orientation. The DNA replicated continuously is called the **leading strand**.

The DNA replication along the other parent strand is discontinuous because of the strand's 5' to 3' orientation. DNA replication on this strand occurs in short fragments called **Oka-zaki fragments** that are synthesized in the direction away from the replication fork. Another enzyme known as **DNA ligase** later connects these fragments into a continuous strand. The DNA replicated in this way is called the **lagging strand**. Because the 5' ends of the lagging strand of DNA cannot be replicated by DNA polymerase, a specialized enzyme called **telomerase** has arisen to replicate the 5' ends.

Much of the accuracy of DNA replication comes from base pairing, but on occasion, mistakes in replication happen. However, several quality control mechanisms are in place to keep the error rate at 1 error/ 10^9 to 10^{12} base pairs. **Genome** (the entire amount of DNA in an organism) sizes in eukaryotes range from 10^9 to 10^{11} base pairs per genome, so this error rate is low enough to prevent many lethal mutations, yet still allows genetic variation to arise.

Mutations Change the Sequence of DNA

Over the course of a lifetime, there are countless opportunities for mistakes to arise in the replication of DNA. A change in a DNA sequence, such as the addition, substitution, or deletion of a base,

is a **point mutation**. If a mutation is not corrected, it may cause a change in the gene product. These changes may be relatively minor, or they may result in dysfunctional gene products that could kill the cell or the organism. Only rarely does a mutation result in a beneficial change in a gene product. Fortunately, our cells contain enzymes that detect and repair damage to DNA.

Some mutations are caused by **mutagens**, factors that increase the rate of mutation. Various chemicals, ionizing radiation such as X-rays and atomic radiation, ultraviolet light, and other factors can behave as mutagens. Mutagens either alter the base code of DNA or interfere with repair enzymes, thereby promoting mutation.

Mutations that occur in body cells are called **somatic mutations**. Somatic mutations are perpetuated in the somatic cells of an individual, but they are not passed on to subsequent generations. However, **germ-line mutations** can also occur. Because these mutations arise in the germ cells of an individual, they are passed on through gametes to future generations.

Oncogenes and Cancer

Proto-oncogenes are normal genes in the genome of an organism that code primarily for protein products that regulate cell growth, cell division, and cell adhesion. Mutations in these proto-oncogenes give rise to **oncogenes** {*onkos*, a mass}, genes that induce uncontrolled cell proliferation and the condition known as **cancer**. The mutations in proto-oncogenes that give rise to cancer-causing oncogenes are often the result of viral activity.

Top Ten Ways to Succeed in Classes that Use Active Learning

By Marilla Svinicki, Ph.D., Director
University of Texas Center for Teaching Effectiveness

- 1 Make the switch from an authority-based conception of learning to a self-regulated conception of learning. Recognize and accept your own responsibility for learning.
- 2 Be willing to take risks and go beyond what is presented in class or the text.
- 3 Be able to tolerate ambiguity and frustration in the interest of understanding.
- 4 See errors as opportunities to learn rather than failures. Be willing to make mistakes in class or in study groups so that you can learn from them.
- 5 Engage in active listening to what's happening in class.
- 6 Trust the instructor's experience in designing class activities and participate willingly if not enthusiastically.
- 7 Be willing to express an opinion or hazard a guess.
- 8 Accept feedback in the spirit of learning rather than as a reflection of you as a person.
- 9 Prepare for class physically, mentally, and materially (do the reading, work the problems, etc.).
- 10 Provide support for your classmate's attempts to learn. The best way to learn something well is to teach it to someone who doesn't understand.

Dr. Dee's Eleventh Rule:

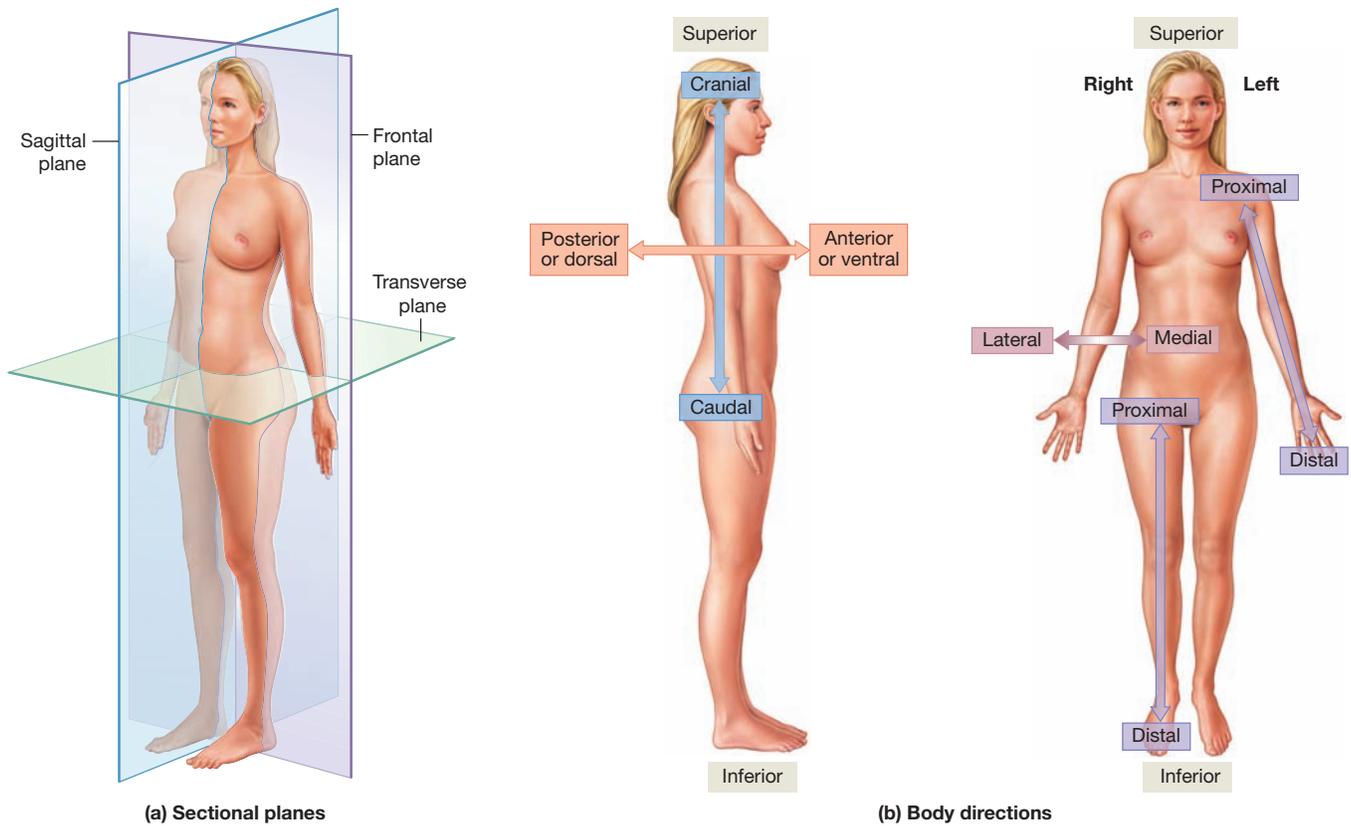
DON'T PANIC! Pushing yourself beyond the comfort zone is scary, but you have to do it in order to improve.

Word Roots for Physiology

a- or an- without, absence	inter- between
anti- against	intra- within
-ase signifies an enzyme	-itis inflammation of
auto self	kali- potassium
bi- two	leuko- white
brady- slow	lipo- fat
cardio- heart	lumen inside of a hollow tube
cephalo- head	-lysis split apart or rupture
cerebro- brain	macro- large
contra- against	micro- small
-crine a secretion	mono- one
crypt- hidden	multi- many
cutan- skin	myo- muscle
-cyte or cyto- cell	oligo- little, few
de- without, lacking	para- near, close
di- two	patho- , -pathy related to disease
dys- difficult, faulty	peri- around
-elle small	poly- many
-emia blood	post- after
endo- inside or within	pre- before
epi- over	pro- before
erythro- red	pseudo- false
exo- outside	re- again
extra- outside	retro- backward or behind
gastro- stomach	semi- half
-gen , -genic produce	sub- below
gluco- , glyco- sugar or sweet	super- above, beyond
hemi- half	supra- above, on top of
hemo- blood	tachy- rapid
hepato- liver	trans- across, through
homo- same	
hydro- water	
hyper- above or excess	
hypo- beneath or deficient	

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Anatomical Positions of the Body



Anterior	(situated in front of): in humans, toward the front of the body (see VENTRAL).
Posterior	(situated behind): in humans, toward the back of the body (see DORSAL).
Medial	(middle, as in <i>median strip</i>): located nearer to the midline of the body (the line that divides the body into mirror-image halves)
Lateral	(side, as in a <i>football lateral</i>): located toward the sides of the body
Distal	(distant): farther away from the point of reference or from the center of the body
Proximal	(closer, as in <i>proximity</i>): closer to the center of the body
Superior	(higher): located toward the head or the upper part of the body
Inferior	(lower): located away from the head or from the upper part of the body
Prone	lying on the stomach, face downward
Supine	lying on the back, face up
Dorsal	refers to the back of the body
Ventral	refers to the front of the body
Ipsilateral	on the same side as
Contralateral	on the opposite side from

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Periodic Table of the Elements

Atomic number = number of protons

Symbol

Name

Atomic mass

Carbon

6

C

12.0

Major essential elements

Minor essential elements

Not believed essential for life

Transitional metals

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period 1	1 Hydrogen H 1.0	2 Helium He 4.0																
Period 2	3 Lithium Li 6.9	4 Beryllium Be 9.0																
Period 3	11 Sodium Na 23.0	12 Magnesium Mg 24.3																
Period 4	19 Potassium K 39.1	20 Calcium Ca 40.1																
Period 5	37 Rubidium Rb 85.5	38 Strontium Sr 87.6																
Period 6	55 Cesium Cs 132.9	56 Barium Ba 137.3																
Period 7	87 Francium Fr (223)	88 Radium Ra 226.0																
	21 Scandium Sc 45.0	22 Titanium Ti 47.9	23 Vanadium V 50.9	24 Chromium Cr 52.0	25 Manganese Mn 54.9	26 Iron Fe 55.8	27 Cobalt Co 58.9	28 Nickel Ni 58.7	29 Copper Cu 63.5	30 Zinc Zn 65.4	31 Gallium Ga 69.7	32 Germanium Ge 72.6	33 Arsenic As 74.9	34 Selenium Se 79.0	35 Bromine Br 79.9	36 Krypton Kr 83.8		
	39 Yttrium Y 88.9	40 Zirconium Zr 91.2	41 Niobium Nb 92.9	42 Molybdenum Mo 95.9	43 Technetium Tc (98)	44 Ruthenium Ru 101.1	45 Rhodium Rh 102.9	46 Palladium Pd 106.4	47 Silver Ag 107.9	48 Cadmium Cd 112.4	49 Indium In 114.8	50 Tin Sn 118.7	51 Antimony Sb 121.8	52 Tellurium Te 127.6	53 Iodine I 126.9	54 Xenon Xe 131.3		
	71 Lutetium Lu 175.0	72 Hafnium Hf 178.5	73 Tantalum Ta 181.0	74 Tungsten W 183.9	75 Rhenium Re 186.2	76 Osmium Os 190.2	77 Iridium Ir 192.2	78 Platinum Pt 195.1	79 Gold Au 197.0	80 Mercury Hg 200.6	81 Thallium Tl 204.4	82 Lead Pb 207.2	83 Bismuth Bi 209.0	84 Polonium Po (210)	85 Astatine At (210)	86 Radon Rn (222)		
	103 Lawrencium Lr (262)	104 Rutherfordium Rf (261)	105 Dubnium Db (262)	106 Seaborgium Sg (263)	107 Bohrium Bh (262)	108 Hassium Hs (265)	109 Meitnerium Mt (266)	110 Darmstadtium Ds (269)	111 Roentgenium Rg (272)	112 Ununbium Uub (277)		114 Ununquadium Uuq		116 Ununhexium Uuh				118 Ununoctium Uuo
	57* Lanthanum La 138.9	58 Cerium Ce 140.1	59 Praseodymium Pr 140.9	60 Neodymium Nd 144.2	61 Promethium Pm (147)	62 Samarium Sm 150.4	63 Europium Eu 152.0	64 Gadolinium Gd 157.3	65 Terbium Tb 158.9	66 Dysprosium Dy 162.5	67 Holmium Ho 164.9	68 Erbium Er 167.3	69 Thulium Tm 168.9	70 Ytterbium Yb 173.0				
	89** Actinium Ac (227)	90 Thorium Th 232.0	91 Protactinium Pa 231.0	92 Uranium U 238.0	93 Neptunium Np (237)	94 Plutonium Pu (239)	95 Americium Am (241)	96 Curium Cm (247)	97 Berkelium Bk (249)	98 Californium Cf (251)	99 Einsteinium Es (252)	100 Fermium Fm (257)	101 Mendelevium Md (258)	102 Nobelium No (259)				

Modern name	Latin name	Symbol
Copper	Cuprium	Cu
Iron	Ferrum	Fe
Potassium	Kalium	K
Sodium	Natrium	Na

Note: Numbers in parentheses are mass numbers (the total number of protons and neutrons in the nucleus) of the most stable or best-known isotope of radioactive elements.

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Glossary/Index

A

$A\beta$ (A-beta) fibers

A band Band of striated muscle sarcomere whose length equals that of the thick filament

abdomen

abdominal aorta

abdominal cavity

abdominal muscles

abdominopelvic cavity

abducens nerve

abnormal cell

abnormal tissue responsiveness

ABO blood group

absolute charge scale

absolute refractory period

absolute temperature

absorption Transfer of substances from the lumen of the kidney or gastrointestinal tract to the extracellular space. *See also* digestion

calcium

capillary filtration

carbohydrate

digestive system

epithelial transport

fat

GI tract

ion

iron

peptide

protein

water

absorptive cell Small intestinal cell. *Synonym:* enterocyte

absorptive state (fed state)

abstinence

accessory glands

accessory nerve (XI)

accessory proteins

acclimation

acclimatization

to exercise in heat

to high altitude

accommodation reflex

accommodation The process by which the eye adjusts the shape of the lens to keep objects in focus

ACE. *See* angiotensin converting enzyme

ACE inhibitor. *See* angiotensin-converting enzyme (ACE) inhibitor

acetoacetic acid

acetylcholine (ACh) Neurotransmitter used by neurons of the central and peripheral nervous system

action potentials in cardiac and skeletal muscle, in comparison of

autonomic pathway

diffuse modulatory system

excitation-contraction coupling

postganglionic autonomic neurotransmitters

receptor for

sympathetic and parasympathetic branches, comparison of

synthesis and recycling of

vasodilation

acetylcholinesterase (AChE) Enzyme that breaks down acetylcholine in the synapse

acetyl CoA. *See* acetyl coenzyme A

acetyl coenzyme A (acetyl CoA) metabolic intermediate that links glycolysis and β -oxidation to the citric acid cycle

acid A molecule that ionizes and contributes an H^+ to a solution)

excretion

secretion

acid-base balance The homeostatic regulation of body pH

acid-base disturbances. *See also* acidosis

acidic solution

acidity. *See also* pH

acidosis Extracellular pH less than 7.38

acidotic state

acid phosphatase

acid reflux

acini (acinar cells). *See also* follicle, thyroid

acquired anemia

acquired immunity Immune responses directed at specific invaders and mediated by antibodies

acquired immunodeficiencies

acquired immunodeficiency syndrome. *See* AIDS

acromegaly Abnormal growth of cartilage and soft tissues due to excess growth hormone secretion in an adult

acrosomal reaction Release of enzymes from the sperm head when it contacts an egg

acrosome Lysosome-like vesicle of sperm that contains powerful enzymes essential for fertilization

ACTH. *See* adrenocorticotrophic hormone

actin A globular protein (G-actin) that polymerizes to form thin filaments (F-actin)

chain

during contraction

fiber

filament

skeletal muscle

smooth muscle

actin-binding site

action potential frequency

action potential Rapid and uniform electrical signal conducted down a cell membrane

absolute refractory period

autorhythmic cell

cardiac contractile cell

cardiac muscle

conduction of

contraction

convergence

firing frequency

graded potential, differentiated from

ion movement

motor neuron

muscle

in neurons

positive feedback loop

presynaptic and postsynaptic inhibition

refractory period

saltatory conduction

in sensory neuron

signal transduction

in skeletal muscle

smooth muscle

in somatic motor neuron

sound transduction

spatial summation

special senses receptor

spindle sensory neuron

stimulus intensity coding and

varicosity

wave energy transduction

activation (channel)

activation (enzyme)

activation (gene)

activation (protein)

activation energy Energy needed to initiate a chemical reaction

activation gate Sodium channel gate that opens to initiate an action potential

active binding site

active enzymes

active expiration

active hormone

active hyperemia An increase in blood flow that

accompanies an increase in metabolism

active immunity

active site Region of an enzyme or transport protein to

which the substrate binds. *Synonym:* binding site

active transport Movement across a membrane that

requires the input of energy from ATP

activin Peptide hormone from the gonads that stimulates

FSH secretion

acuity Keenness of vision

acute inflammatory demyelinating polyneuropathy. *See* Guillain-Barré syndrome

acute motor axonal polyneuropathy (AMAN)

acute mountain sickness

acute-phase protein Liver proteins that act as opsonins and enhance the inflammatory response

acyl unit

$A\delta$ (A-delta) fibers

adapt

adaptation of receptors Process in which sensory receptors decrease their response to a stimulus over time

adaptive immunity (acquired immunity)

addiction

addictive behavior

Addison's disease

addition reaction

adenine Nucleotide base found in ATP, DNA, RNA, and cAMP

amino acid coding and

adenohypophyseal secretions/hormones. *See also* anterior pituitary trophic hormones

adenohypophysis. *See* anterior pituitary; anterior pituitary gland

adenoma

adenosine diphosphate (ADP) Composed of adenine, ribose, and two phosphates

Glossary/Index

- adenosine monophosphate, cyclic (cyclic AMP/cAMP)**
Nucleotide that participates in the transfer of signals between the external environment and the cell
- adenosine** Nucleoside composed of adenine and ribose purine
- adenosine triphosphate (ATP)** An energy-storing compound composed of adenine, ribose, and three phosphate groups
- adenylyl cyclase conversion
- aerobic metabolism
- aerobic production of
- anaerobic metabolism
- carbohydrates
- catabolic pathways
- citric acid cycle
- electron transport system (ETS)
- endergonic reactions
- energy transfer between reactions
- exergonic reaction
- fast-state metabolism
- glucose molecule yield
- glycolysis
- membrane transport
- motor proteins and muscle contraction
- as a neurotransmitter
- proteins used to make taste
- tyrosine kinase receptor
- adenylyl cyclase-cAMP system** The first signal transduction system discovered
- adenylyl cyclase** Membrane-bound enzyme that converts ATP to cyclic AMP
- adequate stimulus** The form of energy to which a particular receptor is most responsive
- ADH. *See* antidiuretic hormone
- adhere
- adherens junctions** Bands that link action microfilaments in adjacent cells together with the help of cadherins
- adipocyte** Fat cells
- adipocytokines
- adiponectin
- adipose cells
- adipose tissue
- adrenergic receptor
- autonomic control of cardiovascular system, transport in
- in fasted state
- adipose lipids
- adjacent cilia
- ADP. *See* adenosine diphosphate
- adrenal catecholamines
- adrenal cortex** Outer portion of adrenal gland that produces steroid hormones)
- control pathway
- hypersecretion
- pituitary gland and the steroid hormone production
- adrenal gland** Endocrine and neuroendocrine gland that sits on top of the kidney)
- adrenal glucocorticoids
- adrenaline. *See* epinephrine
- adrenal medulla** Modified sympathetic ganglion, the inner portion of the adrenal gland that produces catecholamines
- adrenal sympathetic pathway
- adrenergic** Adjective pertaining to epinephrine (adrenaline) or norepinephrine
- adrenergic neuron** Neuron that secretes norepinephrine
- adrenergic receptor** Receptor that binds to norepinephrine or epinephrine
- adrenocorticotrophic hormone (ACTH)** Anterior pituitary hormone that regulates secretion of cortisol from the adrenal cortex
- adrenogenital syndrome
- adult respiratory distress syndrome (ARDS)
- aequorin
- aerobic** Adjective pertaining to a process that requires oxygen
- aerobic catabolism
- aerobic metabolism
- affective behavior** Behaviors related to feeling and emotion
- afferent arteriole** Renal arterioles that bring blood to the glomerulus
- afferent lymph vessel
- afferent neuron. *See* sensory neuron
- afferent pathway** The pathway that connects a receptor to an integrating center
- affinity** The degree to which a protein is attracted to its ligand
- after-hyperpolarization
- afterload
- Agelenopsis aperta*
- agglutination** Clumping of cells together
- aging
- agomelatine
- agonist** Molecules that combine with a receptor and mimic a response
- agouti* mouse
- agouti protein
- AIDS (acquired immunodeficiency syndrome)
- air
- air-filled middle ear
- air flow
- air hunger
- airway** Anatomical structures from mouth to bronchioles that carry air to the alveoli
- autonomic and somatic motor control
- branching of the diameter
- epithelia of glands
- length of the system
- lumen of respiratory system
- upper viscosity of air
- x resistance
- airway resistance
- albumin** Plasma protein made in the liver
- alcohol
- aldosterone** A steroid hormone that stimulates Na⁺ reabsorption and K⁺ secretion in the kidney)
- secretion
- aldosterone-induced proteins
- algorithm
- alkaline phosphatase
- alkaline tide
- alkalosis** Extracellular pH greater than 7.42
- allantois** Extraembryonic membrane that becomes part of the umbilical
- allergen** Any substance capable of triggering an allergic reaction
- allergy (allergic response)
- all-or-none phenomenon
- allosteric activator
- allosteric inhibitor
- allosteric modulation
- allosteric modulator** Binds to an enzyme away from the binding site and change the shape of the active site
- alpha (α) chain
- alpha (α) glucosidase inhibitors
- alpha (α) helix** Spiral configuration formed by some amino acid chains
- alpha (α) ketoglutarate (α KG)
- alpha (α) melanocyte-stimulating hormone (MSH)
- alpha₁ (α_1) receptors
- alpha₂ (α_2) receptor
- alpha-adrenergic receptor** (α receptor) Membrane receptor that binds to norepinephrine and epinephrine
- alpha-blockers
- alpha-bungarotoxin** Snake toxin that is a nicotinic receptor antagonist
- alpha cell** pancreatic cell that secretes glucagon. Synonym: A cell
- alpha-gamma coactivation** Simultaneous activation of alpha and gamma motor neurons so that during muscle contraction, the intrafusal fibers continue to monitor tension in the muscle
- alpha motor neuron** Neurons that innervate extrafusal muscle fibers and cause muscle contraction
- alpha receptor(s). *See* alpha-adrenergic receptor
- alpha wave** Low amplitude, high-frequency brain waves characteristic of the awake-resting state
- ALS. *See* amyotrophic lateral sclerosis
- altering blood vessel endothelium
- alternative splicing** The processing of mRNA to make different proteins from a single strand of DNA
- altitude hypoxia
- altitude sickness
- alveolar air space
- alveolar blood flow
- alveolar-capillary interface
- alveolar P_{CO₂}
- alveolar epithelium
- alveolar gases
- alveolar gas exchange
- alveolar hypoventilation
- alveolar macrophage** Immune cells that patrol the alveoli
- alveolar membrane
- alveolar partial pressure (p gas)
- alveolar Po₂
- alveolar pressure
- alveolar structure
- alveolar ventilation** The volume of fresh air that reaches the alveoli each minute
- alveoli** The exchange surface of the lungs, where oxygen and carbon dioxide transfer between air and the blood
- gas exchange and transport
- Alzheimer's disease
- amacrine cell
- AMAN. *See* acute motor axonal polyneuropathy
- amenorrhea
- American Association for the Advancement of Science (AAAS)
- AMH. *See* anti- Müllerian hormone
- aminase
- amination** Addition of an amino group to a molecule

Glossary/Index

- amine hormones
- amine neurotransmitter** Neurotransmitters made from amino acids, including the catecholamines, histamine, and serotonin
- amines
- amino acid catabolism
- amino acid-derived hormones
- amino acid** Molecule with a central carbon atom linked to a hydrogen atom, an amino group, a carboxyl group, and a variable group of atoms designated "R." The building blocks of proteins
- coding for
- covalent bonds
 - gastric phase
 - hormones derived from metabolism
 - mRNA translation links
 - peptide
 - preprohormone.
 - protein catabolism and protein chains of
 - protein synthesis
 - sequence
 - structure of
 - tyrosine
- amino acid pool
- amino group** Functional group whose composition is $-\text{NH}_2$
- aminopeptidases** Digestive enzyme that removes amino acids from the NH_2 terminal end of a peptide
- ammonia
- ammonia buffer
- ammonium ion
- amnesia
- amnion** Extraembryonic membrane that secretes amniotic fluid
- amniotic fluid
- amoeba
- AMPA receptor** Glutamate receptor-channel that allows net Na^+ influx
- amphetamines
- amphipathic
- amplification
- amplifier enzyme** A membrane enzyme that creates two or more second messengers during signal transduction
- amplitude
- ampulla
- amu. *See* atomic mass unit
- amygdala** Portion of the brain linked to emotion and memory
- amylase** Enzyme that digests starch to maltose
- amylin
- amylin** Peptide cosecreted with insulin
- amyotrophic lateral sclerosis (ALS/Lou Gehrig's disease)
- anabolic metabolism/pathways
- anabolic steroids
- anabolism** Metabolic pathways that require a net input of energy and that synthesize small molecules into larger ones
- anaerobic** Adjective pertaining to a process that does not require oxygen
- anaerobic catabolism
- anaerobic glycolysis
- anaerobic metabolism/pathways
- analgesia
- analgesic drugs
- anal sphincters
- analysis by touch
- anaphylactic shock (anaphylaxis)
- anatomical compartment
- anatomic dead space** The portions of the airways that do not exchange gases with the blood
- anatomy** The study of structure. *See also specific organ, structure, system*
- anaxonic neuron
- anchoring junction** Form of cell-cell or cell-matrix junctions
- anchor protein
- Andersson, Bengt
- Andre the Giant
- androgen-binding protein (ABP)** Sertoli cell protein that binds testosterone to keep it in the lumen of the seminiferous tubule
- androgen** Steroid hormone produced in the gonads and adrenal cortex; dominant hormone in males
- andropause
- androstenedione
- anemia** Pathological state with low hemoglobin
- ANG I. *See* angiotensin I
- ANG II. *See* angiotensin II
- angina
- angiogenesis** The process by which new blood vessels develop, especially after birth
- angioplasty
- angiostatin
- angiotensin converting enzyme (ACE)** Membranebound endothelial enzyme that converts ANGI into ANGII
- angiotensin-converting enzyme (ACE) inhibitor** Drug used to treat high blood pressure by blocking ACE
- angiotensin I (ANG I)
- angiotensin II (ANG II)** Trophic hormone that regulates aldosterone secretion; also raises blood pressure and causes thirst and ADH secretion
- angiotensinogen
- angiotensin receptor blockers (ARBs)
- anion** Negatively charged ions
- anisotropic
- ankyrin-B
- anorexia nervosa (AN)
- ANP. *See* atrial natriuretic peptide
- antacid
- antagonism. *See also* atagonistic control
- hormone
- antagonistic control** Hormones or neurons with opposing effects on some homeostatic function
- antagonistic muscle groups** Flexor-extensor pairs of muscles attached to the same set of bones
- antagonist** One substance opposes the action of another
- anterior corticospinal tract
- anterior pituitary gland** An endocrine gland in the brain that secretes multiple hormones
- anterior pituitary trophic hormones
- anterograde amnesia** Inability to remember newly acquired information
- anterograde axonal transport** Fast transport of vesicles and mitochondria from cell body to axon terminal
- antibiotics
- antibody** A molecule keyed to a particular pathogen that helps target it for destruction. *Synonym:* immunoglobulin)
- antibody coated parasites
- antibody-dependent cell-mediated cytotoxicity** Process in which natural killer cells kill a target cell by binding to the Fc portion of antibodies that are coating the cell
- antibody-mediated immunity
- anticholinesterases
- anticoagulant** Any chemical that inhibits blood coagulation
- anticodon** The tRNA base triplet that pairs with the mRNA codon for an amino acid
- antidepressants
- antidiuretic hormone (ADH, vasopressin)** Posterior pituitary hormone that regulates water reabsorption in the kidney
- antigen-binding sites
- antigen-presenting cell (APC)** Immune cells that ingest and digest pathogens, then insert a fragment of the pathogen into a surface protein
- antigen-specific responses (acquired immunity)
- antigen** Substances that trigger an immune response from the body and that can react with products of that response
- antihistamines
- antihypertensive drug
- anti-inflammatory drugs
- anti-Müllerian hormone** (Müllerian inhibiting substance) Glycoprotein that causes the Müllerian ducts to degenerate during embryonic development
- antioxidants** Molecules that neutralize free radicals
- antiparallel orientation
- antiplatelet agents
- antiport carrier** A membrane transport protein that moves two or more molecules in opposite directions across a membrane
- antipsychotic drugs
- antiviral drugs
- antrum** (1) Distal portion of the stomach; (2) Fluid-filled cavity of mature ovarian follicle
- anus
- anxiety
- aorta** The main artery taking blood from the left ventricle to the body
- aortic body** Region of the aortic wall that contains sensory receptors
- aortic body baroreceptor** Pressure-sensing receptors
- aortic body chemoreceptor** Receptors that respond to PO_2 less than 60mm Hg, decreased pH, or increased P_{CO_2}
- aortic stenosis
- aortic valve** The valve between the left ventricle and the aorta
- AP. *See* action potential
- apex of heart
- apex of lung
- apical
- apical anion channels
- apical membrane/surface** The surface of transporting epithelial cells that faces the lumen of an organ. *Synonym:* mucosal membrane
- apical sodium-hydrogen exchanger (NHE)
- aplastic anemia
- Aplysia*
- apnea** Cessation of breathing
- apoA (apoprotein A)
- apoB (apoprotein B)

Glossary/Index

- apocrine glands
- apolipoprotein** Plasma proteins bound to cholesterol and triglycerides
- apoprotein. *See* apolipoprotein
- apoptosis** (cell suicide) Programmed cell death
- appendix
- appetite
- applied force
- AQP2. *See* aquaporin-2
- aquaporin(s)** Family of membrane water channels
- aquaporin-2 (AQP2)
- aqueous humor** Plasma-like fluid filling the compartment of the eye between the cornea and the lens
- aqueous solution** Solution in which water is the solvent
- arachidonic acid** 20-carbon fatty acid precursor of eicosanoid signal molecules
- arachidonic acid cascade
- arachnoid membrane** The middle membrane layer of the meninges
- arachnoid villi
- ARB. *See* angiotensin receptor blocker
- arcuate artery
- arcuate vein
- ARDS (adult respiratory distress syndrome)
- areola
- Aretaeus the Cappadocian
- arginine** Amino acid precursor of nitric oxide
- Arginine vasopressin (AVP)
- Aristotle
- arm
- aromatase** An enzyme that converts androgens to estrogens
- arousal
- arrector pili muscles
- arrhythmia
- arterial blood
- arterial blood pressure. *See also* blood pressure
- arterial blood values
- arterial blood vessels
- arterial resistance
- arterial venous distribution
- arterial wall
- arteries
- arteriole** The smallest arteries and site of variable resistance in the circulatory system
- blood pressure
- cardiovascular function
 - diameter
 - resistance
 - smooth muscle
- arteriovenous bypass
- artery** Blood vessels that carry blood away from the heart
- ascending colon
- ascending limb of loop of Henle** Portion of the nephron where dilute fluid is produced
- ascending pain pathways
- ascending sensory pathway
- ascending tract** Spinal neurons that carry signals to the brain
- ascending veins
- ascites (abdominal edema)
- ase (suffix)
- aspartate** Amino acid that also acts as an excitatory neurotransmitter
- aspirin
- assisted reproductive technology (ART)
- associated protein. *See* peripheral protein
- association area** Parts of the cerebrum that translate sensory information into perception
- association cortices
- association neuron. *See* interneuron
- Association of American Medical Colleges (AAMC)
- associative learning** Learning that occurs by association of two stimuli
- asthma** Lung disease characterized by bronchoconstriction
- astigmatism** Blurred vision caused by an irregularly shaped cornea
- astrocyte** Glial cells in the CNS that contact both neurons and blood vessels
- asynchronous recruitment** Alternation of active motor units to prevent fatigue
- AT1 receptors
- atherosclerosis** Pathological condition in which lipids and calcium deposit beneath the vascular endothelium
- atherosclerotic plaque
- atmosphere
- atmospheric pressure
- atomic mass** The mass of protons and neutrons in one atom of an element
- atomic mass units (amu)
- atomic number
- atoms** The smallest particle of an element
- ATP. *See* adenosine triphosphate
- ATPases
- ATP-binding cassette (ABC) superfamily
- ATP-gated K⁺ channel** K⁺ channel that closes when the ATP/ADP ratio increases
- ATP hydrolysis
- ATP synthase** The enzyme that couples proton movement across the inner mitochondrial membrane with ATP synthesis. Synonym: F₁F₀ ATPase
- atresia** Apoptosis of ovarian follicles
- atria
- atrial contraction. *See* atrial systole
- atrial diastole
- atrial fibrillation
- atrial natriuretic peptide (ANP)** Peptide hormone from atria of the heart that increases renal Na⁺ and water excretion
- atrial pressure
- atrial primordia
- atrial stretch
- atrial systole
- atrial volume receptor
- atriopeptin. *See* atrial natriuretic peptide
- atrioventricular node (AV node)** The electrical gateway to the ventricles, located near the floor of the right atrium
- atrioventricular node (AV node) delay** Slowing of electrical conduction through the AV node that allows atria to complete contraction before the ventricles begin
- atrioventricular (AV) valves** Heart valves that separate the atria from the ventricles
- atrioventricular (bicuspid) valve
- atrioventricular (tricuspid) valve
- atrioventricular bundle (bundle of His)
- atrium** Upper chamber of the heart that receives blood from the blood vessels
- atrophy
- atropine** Muscarinic receptor antagonist
- attachment protein
- auditory association area
- auditory cortex
- auditory information. *See also* sound
- auditory neurons
- auditory pathway
- Auerbach's plexus
- auscultation
- autism
- autocrine signal** A local chemical signal that acts on the cell that secreted it
- autodigestion
- autoimmune disease** Diseases in which the immune system creates antibodies against the body's own tissues
- autonomic (visceral) reflex
- autonomic control
- autonomic ganglion
- autonomic nervous system** Efferent division of the nervous system that controls smooth muscle, cardiac muscle, glands, and some adipose tissue
- agonists and antagonists in division
- in heart rate modulation
 - in homeostasis
- receptor
- response
 - synapses
 - varicosities
- autonomic neuron** Efferent neurons that control smooth muscle, cardiac muscle, many glands, and some adipose tissue
- autonomic neuropathy
- autonomic neurotransmitters
- autonomic pathways
- autonomous
- autoregulation
- autorhythmic cell** Cardiac cells that spontaneously and rhythmically depolarize and fire action potentials
- autorhythmic myocardium
- autosome** The 22 pairs of chromosomes that contain information for non-sex-related development
- AV (mitral) valve
- average values
- AV node. *See* atrioventricular node
- AV valves. *See* atrioventricular (AV) valves
- axon** An extension of a neuron that carries signals to the target cell
- nervous system
 - neurons
 - postganglionic autonomic neuron
 - axonal Na⁺ channels
- axonal transport** Movement of material between the axon terminal and the cell body
- axon distal
- axon hillock** Region of the axon where it joins the cell body. Often contains the trigger zone
- axon terminal** The distal end of a neuron where neurotransmitter is released into a synapse
- axon varicosity
- axoplasm** Cytoplasm of the axon
- axoplasmic flow** Movement of cytoplasm in the axon. Used for slow axonal transport
- B
- bacteria
- bands. *See also* neutrophil
- Banting, Fredrick G.
- barbiturate
- bar graph
- baroreceptor** Stretch-sensitive mechanoreceptors that respond to changes in pressure

Glossary/Index

- baroreceptor reflex** The primary reflex pathway for homeostatic control of blood pressure
- Barr body** The inactivated X chromosome in each female cell
- barrier method** Contraception based on putting a physical or chemical barrier between egg and sperm
- barriers
- barrier thickness
- basal body** Cytoplasmic structure where microtubules of cilia and flagella terminate
- basal body temperature
- basal cell
- basal compartment
- basal ganglia** Nuclei surrounding the thalamus that help with planning movement
- basal lamina** An acellular layer of extracellular matrix that lies beneath an epithelium, holding the epithelial cells to underlying cell layers. Synonym: basement membrane
- basal metabolic rate (BMR)** An individual's lowest metabolic rate
- basal nuclei. *See* basal ganglia
- base** A molecule that decreases the H^+ concentration of a solution by combining with free H^+
- base (nitrogenous)** A carbon-nitrogen molecule with a ring structure that is an essential component of a nucleotide
- base input
- basement membrane. *See* basal lamina
- base of heart
- base pairing
- basic signal transduction
- basic solution
- basilar membrane** Membrane that separates the cochlear duct from the tympanic duct. It supports the organ of Corti
- basolateral membrane/surface** The sides of transporting epithelial cells that face the extracellular fluid. Synonym: serosal membrane
- basophil** Leukocyte that releases histamine, heparin
- Bayliss, W. M
- β cell. *See* β lymphocyte
- BDNF. *See* brain-derived neurotrophic factor
- Beaumont, William
- bed-wetting
- behavior
- hypothalamus
 - mechanisms
 - response
 - salt and water balance and
- behavioral state system
- benign prostatic hypertrophy
- Bernard, Claude
- Berthold, A. A.
- Best, Charles H.
- beta (β) 1-receptors
- beta (β) 2-receptors
- beta (β) 3-receptors
- beta (β) chain
- beta (β) endorphin
- beta- (β) hydroxybutyric acid)
- beta-adrenergic receptor (β receptor)** Sympathetic target cell receptors
- beta-amyloid protein
- beta-blocker** Drugs that are beta-adrenergic receptor antagonists. Used to treat hypertension
- beta- (β) pleated sheet** Sheet-like structure formed from some chains of amino acids
- beta cells of the pancreas** Endocrine cells that secrete insulin
- beta-oxidation** Process in which fatty acids are broken down by the sequential removal of 2-carbon units
- bicarbonate ion (HCO_3^-) and enzymes (pancreas) secretion
- surface mucous cells
- synthesis
- biceps
- biceps brachii muscle
- biconcave disk shape
- bicuspid valve** The left AV valve of the heart. Synonym: mitral valve
- bile** A solution secreted by the liver and composed primarily of bile acids, bile pigments and cholesterol
- bile acid** Steroid detergents made from cholesterol by the liver
- bile acid sequestrants
- bile canaliculi** Liver channels through which bile is secreted
- bile duct
- bile pigments
- bile salt** Bile acids conjugated with amino acids
- bile secretion
- bilirubin** Breakdown product of heme groups from hemoglobin
- binding protein
- binding site
- binocular vision** Three-dimensional vision from overlapping visual fields of two eyes
- binocular zone
- biochemical pathways
- biochemistry of carbohydrates
- biochemistry of lipids
- biochemistry of proteins
- bioenergetics
- biological membranes
- biological reactions
- biological rhythm** The cyclic variation of a biological process
- biological signal transduction
- biological solutions
- biological transport
- biomolecule** Organic molecules associated with living organisms: carbohydrates, lipids, proteins and nucleotides
- biorhythms. *See* biological rhythm
- biosphere
- biosynthesis
- biotechnology
- bipolar cell
- bipolar-ganglion synapse
- bipolar neuron** Neuron with a single axon and single dendrite
- bipotential gonad** Embryonic tissue that has the potential to develop into either testis or ovary
- bipotential stage
- birth control
- birth process
- 2,3-bisphosphoglycerate (2,3-BPG). *See* 2,3-diphosphoglycerate
- bisphosphonates
- bitter ligand
- bitter taste
- bladder. *See* urinary bladder
- bladder sphincter
- blast (suffix)
- blastocyst** Early embryo, consisting of a hollow ball of cells
- bleaching of visual pigment
- bleb** Weakened section of the lung tissue
- bleeding/blood loss. *See* hemorrhage
- blind-end lymph capillaries
- blind spot** Region of the retina with no photoreceptors because the optic nerve and blood vessels exit the eye. Synonym: optic disk
- blind study** An experiment in which the subject does not know if he or she is receiving the experimental treatment or a placebo
- blood** The circulating portion of the extracellular fluid
- amino acids
 - AVP release into the
 - blood cell production
 - digestive system
 - distribution in the body at rest
 - exchange of gases between the atmosphere and the external respiration
 - fat synthesis
 - gas transport in the
 - half-life of steroid hormones, transport in the hormone secretion into the
 - loss from damaged vessels
 - oxygenated
 - oxygen content of
 - plasma
 - plasma and the cellular elements of
 - platelets and coagulation
 - red blood cell
 - vessels
 - viscosity
 - volume
 - water absorption by osmosis into the
- blood amino acids
- blood-brain barrier** Tight junctions in the brain capillaries that prevent free exchange of many substances between the blood and the cerebrospinal fluid
- blood cells. *See also specific type*
- blood clot
- blood count
- blood doping
- blood flow. *See also specific type of blood vessel*
- arterioles, resistance in the
 - blood pressure
 - blood vessels
 - capillaries, exchange at the
 - cardiovascular disease
 - cardiovascular function
 - distribution of blood to the tissues
 - individual blood vessels, through
 - lymphatic system
 - tissue per minute
 - total flow
 - velocity of
 - volume per 100 grams
- blood flow during exercise
- blood gases
- blood gases and exercise
- blood glucose
- blood groups (blood types)
- bloodletting (venesection)
- blood loss. *See* hemorrhage
- blood pressure** The pressure exerted by blood on the walls of the blood vessels. Usually measured in the systemic arteries
- arterial
- arteries and veins
 - baroreceptor refl ex
 - blood volume
 - cardiac output
 - cardiovascular control

Glossary/Index

- blood pressure** (*Continued*)
 cardiovascular disease and
 control
 elevated, response to
 exercise
 and exercise
 integrated responses to
 mean arterial pressure (MAP)
 peripheral resistance
 responses triggered by changes in
 sodium balance
 sphygmomanometry
 vasopressin release
 blood pressure and exercise
 blood pressure control
 blood sinuses
 blood substitutes
blood-testis barrier Tight junctions between Sertoli cells that
 prevent free exchange between the extracellular
 fluid and the lumen of the seminiferous tubules
 blood type (blood groups)
 blood values
 blood vessel endothelium
 blood vessels
 angiogenesis
 arteries and arterioles
 capillaries
 cardiovascular system
 damage to wall
 diameter
 dilation
 heart
 length
 pressure waves
 radius
 structure
 vascular smooth muscle
 veins
 venules
 walls of
 blood volume
 β lymphocyte (B cell) White blood cell that secretes
 antibodies
 BMR. *See* basal metabolic rate
 BNP. *See* brain natriuretic peptide
 body
 calcium balance in the
 communication in the
 compartments
 energy balance in the
 fluid volume
 function
 functional compartments of the
 heart and major blood vessels
 pathogens of the human
 pH balance in the
 protein
 systems
 thermostat
 tissues of the
 water balance in the
 body acids
 body bases
 body cavities
 body compartments
 body defense
 body fluid
 body fluid compartment. *See also* extracellular fluid (ECF);
 intracellular fluid (ICF)
 body heat
 body load, in mass balance
 body mass index (BMI)
 body movement
 autonomic reflexes
 control of
 integrated control of
 neural reflexes
 skeletal muscle reflexes
 body osmolarity
body temperature Normal human body temperature is 37°
 C or 98.6° F
 body water
 body weight
Bohr effect The effect of a change in pH on hemoglobin
 binding of oxygen
bolus A mass
bomb calorimeter Instrument that determines the caloric
 content of food by combustion bond, chemical
bone Calcified connective tissue
 calcium in
 cortex
 disease
 loss
 matrix
 resorption
 bone growth
 bone loss
bone marrow A soft tissue that fills the hollow centers of
 bones; site of hematopoiesis
 bony cochlear wall
 bordetella pertussis toxin
 Botox®
 botulinum toxin/botulism
 bouton. *See* axon terminal
Bowman's capsule The initial segment of the renal tubule.
 Receives filtered fluid from the glomerular
 capillaries
 Boyle, Robert
Boyle's law If the volume of a gas increases, the pressure
 decreases, and vice versa. $P_1 V_1 = P_2 V_2$
 brachial artery
bradycardia Slow heart rate
bradykinin A paracrine vasodilator
 brain
 anatomy of the
 ascending pathways
 auditory pathway
 blood flow
 body movement, control of
 central nervous system
 functions of. *See also specific type*
 hypoglycemia and the
 lateral view of the
 Medulla oblongata at
 mid-sagittal view of
 plasma glucose homeostasis
 reproduction control
 sensory pathways
 sexual reproduction and
 sodium balance
 somatosensory cortex
 spinal cord organization
 strong signal
 timing differences
 ventricles
Brain Architecture: Understanding the Basic Plan (Swanson)
 brain capillaries
 brain center
 brain-derived neurotrophic factor (BDNF)
 brain functions
 brain metabolism
 brain natriuretic peptide (BNP)
brain stem Portion of the brain closest to the spinal cord;
 contains centers for many unconscious body
 functions
 control ventilation
 networks
 branching fibers
 breast
 breast feeding (lactation)
 breathing
 cessation of
 efficiency of
 gas laws
 medullary control of
 neural activity during quiet
 neurons in the medulla control
 normal quiet
 pressure changes during quiet
 rapid
 rate and depth of
 respiratory system
 surfactant decreases the work of
 thoracic cage and diaphragm, movement during
 ventilation
Broca's area Speech center in the frontal lobe
 bronchi
 bronchial artery
bronchiole Small collapsible airways with smooth muscle
 walls
 bronchitis, chronic
 bronchoconstriction
 bronchodilation
 bronchus
brown fat Adipose cells that contain multiple lipid droplets
 Brown-Séquard, Charles
brush border Name given to microvilli covering the luminal
 surface of intestinal and renal tubule epithelia
 brush border enteropeptidase
 bucket handle motion
buffer A molecule that moderates changes in pH
bulbourethral (Cowper's) gland Male accessory gland that
 produces components of semen
 bulimia nervosa (BN)
bulk flow Mass movement of water or air as the result of
 pressure gradients
bundle branch Two branches of the bundle of His that carry
 electrical signals to each ventricle
bundle of His (atrioventricular bundle) Specialized electrical
 conducting cells of the heart that carry signals into
 the ventricles
 bungarotoxin
Bungarus multicinctus
 bupropion (Zyban®)
 bursting pacemaker neurons
 Bush, Barbara
 Bush, George H. W.
 butterfly-shaped gland
 Byetta®. *See* exendin
 bypass channels
C
 Ca²⁺. *See* calcium ion
 Ca²⁺-ATPase. *See* calcium ATPase
 Ca²⁺-sensing receptor (CaSR)
 cable properties
cadherin Membrane-spanning protein of adhesive junctions
 that links two cells together

Glossary/Index

- caffeine
- Cajal, interstitial cells of
- Cajal, Santiago Ramón
- calbindin
- calcification
- calcitonin** Thyroid gland hormone that decreases plasma Ca^{2+} concentrations in lower animals
- calcitonin gene-related peptide (CGRP)** Neuronal peptide that is coded by the same gene as calcitonin
- calcitriol (vitamin D3)
- calcium (Ca^{2+})
- absorption
 - autonomic synapses
 - cardiac EC coupling (factor IV)
 - influx
 - intercellular cement
 - intracellular messenger
 - myocardial autorhythmic cells and phosphate homeostasis
 - sensitivity
 - signal molecule
 - signal transduction
 - somatic motor division
 - troponin interaction
- calcium ATPase** Membrane transporter that moves Ca^{2+} against its concentration gradient
- calcium balance
- calcium-binding proteins
- calcium censor
- calcium channel** Ion channel that allows movement of Ca^{2+} across a membrane
- calcium channel blocker** Drugs that block Ca^{2+} channels; used to treat high blood pressure
- calcium-induced Ca^{2+} release** Process in which Ca^{2+} entry into a muscle fiber triggers release of additional Ca^{2+} from the sarcoplasmic reticulum
- calcium ion. *See also* calcium
- calcium phosphate
- calcium release channel
- calcium signal
- calcium store
- calmodulin** Intracellular second messenger that binds Ca^{2+}
- calorie
- CaM. *See* calmodulin
- CAM. *See* cell adhesion molecule
- cAMP. *See* cyclic AMP
- campylobacter jejuni*
- canal of Schlemm
- cancer
- candidate hormone** Molecules that have not been shown to fulfill all the qualifications of a hormone
- cannabinoid receptors
- cannabis sativa*
- Cannon, Walter B.** The father of American physiology
- Cannon's postulates
- capacitance
- capacitation** Changes in sperm that confer the ability to swim rapidly and fertilize an egg
- capacitor
- CAPD. *See* continuous ambulatory peritoneal dialysis
- capillary** Smallest blood vessels where blood exchanges material with the interstitial fluid
- blood flow
 - cardiovascular system
 - of digestive tract
 - exchange at the
 - of liver
 - pressure
 - spleen
- capillary absorption
- capillary beds
- capillary blood pressure
- capillary blood supply
- capillary endothelium
- capillary exchange** Movement of fluid between the plasma and interstitial fluid across the capillary endothelium
- capillary filtration
- capillary hydrostatic pressure
- capillary lumen
- capsaicin
- capsid, viral
- capsular epithelium
- capsule
- capsule fluid pressure
- capsule of connective tissue
- carbaminohemoglobin** Hemoglobin with bound carbon dioxide
- carbohydrate** Biomolecule whose basic structure is $(\text{CH}_2\text{O})_n$. Includes sugars, starch, glycogen
- absorption
 - metabolism
 - monosaccharides, are absorbed as
- carbon acyl unit
- carbon dioxide (CO_2)** Gaseous product of aerobic respiration
- aerobic metabolism produces
- alveolar-capillary interface, enters alveoli and bicarbonate ions
 - chemoreceptor response
 - diffusion out of cells
 - removal at the lungs
 - solubility
 - transport
 - ventilation, influence on
- carbon dioxide, transportation
- carbonic acid (H_2CO_3)
- carbonic anhydrase** Enzyme that catalyzes the conversion of carbon dioxide and water into carbonic acid
- carbon monoxide (CO)
- carboxyl group
- carboxypeptidase** Enzyme that breaks peptide bonds at the carboxy terminal end of a peptide
- carboxy-terminal end
- cardiac arrhythmia
- cardiac autorhythmic cells
- cardiac chambers
- cardiac contractile cell
- cardiac contraction
- cardiac cycle** The period of time from the end of one heartbeat through the end of the next beat
- cardiac EC coupling
- cardiac glands
- cardiac glycoside** Drugs such as ouabain and digitalis that block the Na^+/K^+ -ATPase
- cardiac muscle** Striated muscle of the heartfibers and the heart
- smooth muscle
- cardiac output (CO)** The amount of blood pumped per ventricle per unit time
- cardiac performance
- cardiogenic shock
- cardiovascular control center (CVCC)** Neurons in the medulla oblongata that integrate sensory information and direct autonomic responses aimed at maintaining adequate blood pressure
- cardiovascular disease
- cardiovascular reflexes
- cardiovascular response
- cardiovascular system** The heart and blood vessels
- blood
- blood pressure control
 - blood vessels
 - cardiac muscle
 - fluid flow
 - function
 - functional model of the heart
 - heart as a pump
 - material transport
 - mechanisms
 - overview of the pressure, volume, flow and resistance transport in the
- carotid body baroreceptor** Receptor in carotid artery that monitors blood pressure
- carotid body chemoreceptor** Receptor in the carotid artery that responds to low arterial P_{O_2} decreased pH, or increased P_{CO_2}
- carotid body oxygen sensor
- carrier-mediated transport
- carrier protein** Membrane protein that binds to the molecule it transports. Synonym: transporter
- carriers (genetic)
- CART (cocaine-and-amphetamine-regulated transcript)
- cartilage** Firm, elastic connective tissue with collagen fibers
- cartoid arteries
- cartoid baroreceptors
- cartoid bodies
- cartoid chemoreceptors
- cascade** Response in which a series of inactive molecules convert to active forms until a product is formed
- arachidonic acid
- coagulation
 - complement
 - enzyme
 - kinin
 - signal transduction pathways
 - transducin
- castration** Removal of the gonads
- catabolic metabolism/pathways
- catabolism** Reactions that release energy and result in the breakdown of large biomolecules
- catalase** Enzyme that converts peroxide to oxygen and water
- catalyst** A molecule that speeds up the rate of a chemical reaction without itself being changed
- catecholamine** Signal molecule formed from tyrosine; includes epinephrine, norepinephrine, and dopamine
- cation** Positively charged ions
- caveolae
- caveolin
- cavities (body)
- CBG. *See* corticosteroid-binding globulin
- CB receptors. *See* cannabinoid receptors

Glossary/Index

- C cell** Thyroid cell that secretes calcitonin
- CCK.** *See* cholecystokinin
- cecum** The initial section of the large intestine
- cell** The basic functional unit of most living organisms. *See also specific cell*
- autosomes
 - body composition
 - carbon dioxide diffusion
 - chemical signal response
 - coagulation
 - communication
 - compartmentalizing enzymes in the compartmentation
 - of corona radiata
 - damaged
 - depolarization
 - diffusion barrier between lung and blood, form a digestive system
 - external respiration
 - extracellular fluid (ECF)
 - facilitated diffusion of glucose into function
 - gas exchange and transport
 - growth
 - hormone secretion
 - hyperpolarization
 - intracellular fluid (ICF)
 - metabolic pathway regulation
 - metabolism
 - modulated responses
 - nervous system
 - nucleus of the organelles
 - oxygen diffuses into
 - platelets
 - products
 - properties
 - proteins and
 - receptor
 - receptor proteins
 - response
 - resting membrane potential
 - signaling
 - signal pathways, terminate
 - spindle-shaped
 - structure
 - swells
 - into tissues
- cell adhesion molecule (CAM)** Membrane proteins that link cells to each other and to the extracellular matrix
- cell body** Part of the cell that contains the nucleus and many organelles. *Synonym:* cell soma
- neurons
 - sensory receptor
 - stimulus coding
- cell-cell adhesions
- cell-to-cell communication** Chemical and electrical processes by which cells coordinate their functions
- cell—cell contact
- cell-cell junctions
- cell death. *See* cell apoptosis
- cell junction** Membrane proteins and extracellular matrix that hold cells together to form tissues
- cell-matrix adhesions/junctions
- cell-mediated immunity** Immune reaction that requires T lymphocytes to come in contact with the antigen
- cell membrane** The cell membrane that serves as both a gateway and a barrier for substances moving into and out of the cell
- of an axon
 - Ca²⁺ entry
 - communication between the cell and its environment
 - components
 - freeze fracture of
 - Na⁺-K⁺-ATPase and
 - physical isolation
 - receptor
 - receptor proteins in the
 - regulation of exchange with the environment
 - resting membrane potential
 - sarcolemma
 - signal pathway
 - structural support
- cell process** Extensions of a cell such as dendrites and axons
- cell shape
- cell soma. *See* cell body
- cellular elements
- cellular energy use
- cellular homeostasis
- cellular mechanism of action of hormone** The intracellular events through which the hormone's message is carried out
- of insulin
- peptide hormones
 - steroid hormones
 - cellular metabolism
- cellular oxygen consumption
- cellular respiration** Intracellular reaction of oxygen with organic molecules to produce CO₂, water, and energy in the form of ATP
- cellulose
- cell volume
- centimeters
- centimeters of water
- central artery
- central body
- central canal
- central chemoreceptor** Chemoreceptor in the medulla oblongata that monitors plasma Pco₂
- central fatigue** Subjective feeling of fatigue during exercise
- central hearing loss** Hearing loss due to damage to the auditory cortex or the neural pathways between it and the ear
- central nervous system (CNS)** Brain and spinal cord
- anatomy of the
 - behavioral state system
 - blood-brain barrier protects the brain
 - bone and connective tissue support the brain
 - brain
 - brain functions
 - cerebrospinal fluid
 - control center, depression of
 - gray matter and white matter, divided into
 - hollow tube, develops from a
 - innervate intrafusal fibers
 - input
 - integrating center
 - integrating region within the interneurons
 - movement integration
 - muscle fatigue
 - muscle stretch
 - neural reflex pathways classification
 - neural tissue has special metabolic requirements
 - neurons
 - point of origin
 - polysynaptic reflexes
 - posterior view of the
- sensory system
 - spinal cord
 - tonically active sensory neurons
- central pattern generator** Networks of CNS neurons that function spontaneously to control certain rhythmic muscle movements
- central receptor** Sensory receptors located in or closely linked to the brain
- central sensory receptor
- central sinus
- central thermoreceptors
- centriole
- centrosome** The cell's microtubule-organizing center
- cephalic
- cephalic phase** Digestive reflexes triggered by stimuli received in the brain, such as the smell or sight of food
- cephalic reflex
- cerebellum** Portion of the brain that coordinates the execution of movement
- central nervous system
- cerebral capillary
- cerebral cortex** Outer portion of the cerebrum that carries out higher cognitive functions
- central nervous system
- cerebral edema, high-altitude
- cerebral hemisphere
- cerebral hemorrhage
- cerebral lateralization** Asymmetrical distribution of function between the left and right sides of the brain
- cerebrospinal fluid (CSF)** A salty solution that is continuously secreted into the ventricles of the brain
- cerebrum** Largest region of the brain
- cerumen
- cervical canal
- cervical cancer
- cervical cells
- cervical dilation
- cervical lymph nodes
- cervical mucus
- cervical spinal cord/nerves
- cervical stretch
- cervix** Neck of the uterus that opens into the vagina
- C fibers
- CFTR channel. *See* cystic fibrosis transmembrane regulator
- cGMP. *See* cyclic GMP
- CGRP. *See* calcitonin gene-related peptide
- channel kinetics** The speed with which channels open, close, or deactivate
- channelopathy
- channel protein** A membrane protein that forms water-filled channels to link intracellular and extracellular compartments
- channels, axonal Na⁺
- channels, chemoreception
- channels, ion
- chemical bond** The physical forces that attract and hold atoms together
- chemical communication
- chemical digestion
- chemical disequilibrium
- chemical equilibrium** Reaction in which the forward and reverse rates of the reaction are equal so that there is no net change in the concentrations of products or reactants
- chemical gradient

Glossary/Index

- chemically gated channel** Channels whose open state is controlled by binding to a chemical ligand
- chemical modulator
- chemical reaction** A substance undergoes a chemical change to become a different substance by breaking existent covalent bonds or making new bonds
- chemicals, mediating vasoconstriction and vasodilation
- chemical signal
- chemical synapse** Synapse that uses neurotransmitters to pass information to the target cell
- chemical work** Energy used for growth, reproduction, repair, homeostasis, and information storage
- chemiosmotic theory of oxidation phosphorylation**
Model of mitochondrial ATP production that links H⁺ transport across the inner mitochondrial membrane to ATP synthesis
- chemoreception
- chemoreceptor** A sensory receptor that is activated by binding of a chemical substance
- chemotaxin** A molecule that attracts cells such as white blood cells
- chest wall
- chief cell** A cell of the stomach that secretes pepsinogen
- chloride channel. *See* cystic fibrosis transmembrane regulator
- chloride ion (Cl⁻)
- chloride shift** Process in which red blood cells exchange HCO₃⁻ for Cl⁻
- cholecystokinin (CCK)** Intestinal hormone that regulates digestive function and may play a role in appetite
- cholera
- cholera toxin
- cholesterol** A steroid that serves as the basis for steroid hormones; also a key component of membranes
- choline
- cholinergic neuron** A neuron secreting acetylcholine
- cholinergic receptor
- cholinesterase inhibitors
- chondroblasts
- chondrocyte** Cells that produce cartilage
- chordae tendineae** Collagenous cords that prevent the atrioventricular valves from being pushed back into the atria during ventricular contraction
- chorion
- chorionic gonadotropin
- chorionic somatomammotropin. *See* human placental lactogen
- chorionic villi
- choroid layer
- choroid plexus** A transporting epithelium that secretes cerebrospinal fluid
- chromaffin cells** Modified postganglionic sympathetic neurons in the adrenal medulla that secrete epinephrine
- chromatid, sister
- chromium
- chromium picolinate. *See also* chromium
- chromosome
- chronic bronchitis
- chronic hypoxia
- chronic inflammatory diseases
- chronic obstructive pulmonary disease (COPD)** Pulmonary diseases characterized by nonreversible decreased air flow through bronchioles; emphysema and chronic bronchitis
- chronic stress
- Chrysaora fuscescens*
- chylomicron** Large droplets of triglycerides, cholesterol, proteins, and lipoproteins that are synthesized in cells of the small intestine
- chylomicron remnant
- chyme** A soupy substance produced by digestion in the digestive tract
- chymotrypsin
- chymotrypsinogen
- cilia** Short, hair-like structures whose movement creates currents that move fluids or secretions across the cell surface
- ciliary muscle** Muscle in the eye whose contraction slackens zonules and rounds the lens
- ciliated epithelia** Epithelia covered with cilia that move fluid over the surface
- ciliopathies
- cimetidine
- cingulate gyrus
- circadian rhythm** Biological rhythm based on a 24-hour cycle
- circuits
- circular muscle
- circulating leukocytes
- circulatory system** The heart and blood vessels
- circumcision** Removal of the foreskin of the penis
- cisternae
- citation formats
- citric acid cycle** Key metabolic pathway of aerobic respiration. Synonyms: Krebs cycle, tricarboxylic cycle, TCA cycle
- Cl⁻. *See* chloride ion
- classic hormones
- clast (suffix)
- clathrin
- clathrin-coated pit
- claudin
- clearance** A measurement of the disappearance of a substance from the blood, expressed as milliliters of plasma cleared of solute per unit time
- clitoris
- cloacal opening
- clonal deletion
- clonal expansion** Reproduction of one type of lymphocyte following exposure to an antigen
- clone** A group of cells that are genetically identical
- closed channel
- Clostridium botulinus*
- Clostridium tetani*
- clot
- clotting factor
- clotting factor I. *See* fibrin
- clotting factor II. *See* thrombin
- clotting factor III. *See* tissue factor
- clotting factor IV. *See* calcium
- clotting process
- clotting protein
- CNG channels. *See* cyclic nucleotide-gated channels
- Cnidaria*
- CNS. *See* central nervous system
- CO. *See* carbon monoxide; cardiac output
- coagulation** Process in which fluid blood forms a gelatinous clot
- coagulation cascade
- coarse touch
- coated pit
- cobalamin
- cocaine
- coccus
- coccygeal nerve
- cochlea** Coiled structure of ear that contains receptors for hearing
- cochlear duct (endolymph)
- cochlear nerve
- cochlear nuclei
- coding
- coding, stimulus intensity
- codon** Triplet of DNA or mRNA bases that encodes information for one amino acid
- coenzyme** Organic cofactors that act as receptors and carriers for atoms or functional groups that are removed from substrates during the course of a reaction
- cofactor** An inorganic or nonprotein organic molecule required for activation of protein
- cognition
- cognitive behavior** Behaviors that deal with thought processes rather than emotion
- cognitive system
- cold receptors
- colipase** A protein cofactor that allows lipase to break through the bile salt coating of an emulsion
- collagen** Flexible but inelastic protein fibers of connective tissue
- collagenase** Enzyme that degrades collagen
- collagen fibers
- collateral** Branch of an axon
- collateral arteries
- collateral circulation
- collateral pathways
- collecting duct** Terminal region of the kidney tubule
- colligative
- colloid
- colloid osmotic pressure (π)** Osmotic pressure that due to the presence of plasma proteins that cannot cross the capillary endothelium. Synonym: oncotic pressure
- colon** Proximal portion of the large intestine.
- colonic crypt cells
- colonocyte** Transporting epithelial cell of the large intestine
- colony-stimulating factor (CSF)** Cytokines made by endothelial cells and white blood cells that direct the production and development of white blood cells
- color-blindness
- colostrum** Watery, low-fat secretions of the mammary gland prior to delivery
- columnar, cell shape
- columnar epithelial cell
- coma
- combination reaction
- committed progenitor cells
- common bile duct
- common carotid artery
- common hepatic duct
- common molecule receptors
- common pathway
- common signal molecules
- communicating junction
- communication
- local
- long-distance
- neighboring cells

Glossary/Index

- compact bone
- compartment
- compartmentalizing enzymes
- compartmentation** The internal division of the body or cell into compartments so that functions can be isolated from one another
- competition
- competitive inhibitor** Molecules that bind to the active site of the enzyme, preventing substrate binding
- complement** A group of plasma enzymes that are involved in immune function
- complete (fused) tetanus** Sustained maximal contraction of a muscle in response to repeated stimuli
- complete heart block
- complex biosynthesis
- complex carbohydrates
- complex chemical signaling
- complex endocrine pathways
- complex neural receptors
- complex neuroendocrine reflex
- complex pathways
- complex reflex control pathways
- complex reflex pathways
- complex signal transduction pathways
- compliance** The ability of the lung or other tissue to stretch compressed air
- concave lens
- concentration** The amount of solute per unit volume of solution
- concentration gradient** A difference in the concentration of a substance between two places
- concept map
- condition
- conditioned reflex
- conductance (G)
- conducting system** Of airways
- conduction
- conduction signal
- conductive hearing loss** Hearing loss due to failure of sound transmission through outer or middle ear
- conductive heat gain
- conductive heat loss
- conductor
- cone** A photoreceptor for high acuity vision and color vision during the daytime
- cone pigment
- conformation
- congenital diabetes insipidus
- congestive heart failure** Pathological condition in which the left ventricle fails to pump blood adequately, causing backup of fluid into the lungs
- conjugated protein** Molecules of protein combined with either lipid or carbohydrate
- connective tissue
- connexin** Membrane-spanning proteins that form gap junctions; capable of opening and closing
- connexon** The protein channel of a gap junction, made of connexins
- consciousness
- conscious stimulus processing
- consensual reflex** Light shined in one pupil constricts both pupils
- consolidation** Process that converts short-term memory to long-term memory
- constipation
- constitutive/constitutive process** Any essential bodily function that is always taking place
- contact-dependent signals** Cell-cell signals that require surface molecule binding between two cells
- continuous capillary** Capillary whose endothelial cells are tightly joined
- continuous feedback
- contractile cell
- contractile component
- contractile fiber
- contractile myocardium
- contractile myoepithelium
- contractility** The intrinsic ability of a cardiac muscle fiber to contract at any given fiber length
- contraction
- cardiac contractile cell
- cardiac muscle cells
- cycle
- electrical signals coordinate
- force
- GI smooth muscle
- heart
- pattern
- phase
- speed
- systole
- contralateral** On the opposite side from ,
- control** Part of an experiment designed to ensure that any observed changes are due to the experimental manipulation and not to an outside factor/control center
- control pathway
- control systems
- Conus geographus*
- convection
- convective heat loss** Heat that is carried away by warm air that rises
- convergence** A number of presynaptic neurons provide input to a smaller number of postsynaptic neurons
- convergent pathway
- conversion
- convex lens
- convex lens converge
- coordination
- core body temperature
- cornea** The clear covering of the anterior surface of the eye
- corona radiata
- coronary artery** Artery supplying blood to the heart muscle
- coronary artery disease
- coronary heart disease (CHD)
- coronary sinus
- coronary veins
- corpora cavernosa** Two columns of erectile tissue in the penis
- corpus albicans** The remnants of a degenerated corpus luteum
- corpus callosum** The central region where neurons pass from one hemisphere of the cerebrum to the other
- corpus luteum** Ovarian structure that produces estrogen and progesterone after ovulation
- corpus spongiosum** A column of spongy erectile tissue in the penis
- cortex** Literally, bark; the outer or surface portion of an organ
- cortex medulla
- cortical association areas
- cortical centers
- cortical collecting duct
- cortical granules** Cytoplasmic granules in the egg that contain chemicals to prevent polyspermy,
- cortical nephron
- cortical reaction** Chemical reaction that changes the zona pellucida after fertilization so that additional sperm cannot reach the egg
- corticospinal neurons
- corticospinal pathways
- corticospinal tract** Neurons from motor cortex to spinal cord
- corticosteroid-binding globulin (CBG)
- corticosterone
- corticotropin
- corticotropin-releasing hormone
- corticotropin-releasing hormone (CRH)** Hypothalamic hormone that regulates secretion of ACTH from the anterior pituitary
- cortisol** Steroid hormone from the adrenal cortex that regulates metabolism, particularly during stress
- endocrine system
- Corynebacterium diphtheria*
- co-secretion** Secretion of more than one compound from a secretory vesicle
- cotransporter** A protein that moves more than one kind of molecule at one time
- cough
- countercurrent
- countercurrent exchange system** Anatomical arrangement of vessels so that flow in one vessel is in the opposite direction from flow in the adjacent vessel
- countercurrent heat exchanger
- countercurrent mechanisms
- countercurrent multiplier** Anatomical arrangement of the loop of Henle that concentrates solute in the renal medulla
- coupled reactions** Reactions where energy released by one reaction drives the coupled reaction that requires energy
- covalent bond** Bonds created by two atoms that share one or more pairs of electrons
- covalent modulator** Atoms or functional groups bind to proteins and affect their activity
- Cowper's glands
- C-peptide
- cranial cavity
- cranial nerve** 12 pairs of peripheral nerves that originate primarily from the brain stem
- cranial nerve I
- cranial nerve III
- cranial nerve IX
- cranial reflex
- cranium
- C-reactive protein (CRP)
- creatine
- creatine kinase (CK)** Enzyme that transfers a high-energy phosphate group from phosphocreatine to ADP
- creatine phosphokinase (CPK)
- creatinine** The breakdown product of phosphocreatine
- crenated
- cretinism** Congenital hypothyroidism that causes mental retardation and short stature
- CRH. *See* corticotropin-releasing hormone
- crista (vestibular apparatus)
- cristae (mitochondria)** Folds of the inner membrane of a mitochondrion
- crossbridge** Connection formed when mobile myosin heads bind to actin molecules in muscle

Glossary/Index

- crossbridge tilting
- crossed extensor reflex** A postural reflex that helps maintain balance during flexion reflexes
- cross-linkage
- cross-linked fibrin
- cross-linked fibrin polymers
- crossover effect
- crossover study** Experimental design in which the subjects spend half the time on the experimental treatment and half the time on placebo
- cross-sectional area
- cross-sectional studies
- crypt** Deep pockets created by the highly folded surface of the intestine
- crypt cell
- crypt lumen
- cryptorchidism** Failure of one or both testes to descend into the scrotum
- cuboidal
- cupula** Gelatinous mass in the vestibular apparatus that contains cilia of hair cells
- curare
- current
- current flow
- current flow vector
- current leak
- Cushing, Harvey
- Cushing's syndrome
- cutaneous blood vessels
- cyanosis** Blue appearance to the skin and mucous membranes due to excessive amounts of reduced hemoglobin
- cyclic AMP (cAMP/cyclic adenosine-3',5'-monophosphate)** Nucleotide that participates in the transfer of signals between the external environment and the cell
- cyclic GMP (cGMP/cyclic guanosine-3',5'-monophosphate)
- cyclic nucleotide-gated channels (CNG channels)
- cyclooxygenase (COX)** Enzyme that converts arachidonic acid to prostanooids
- cylindrical fibers
- cysteine
- cystic fibrosis (CF)
- cystic fibrosis transmembrane regulator (CFTR channel)** Nucleotide-gated chloride channel in epithelia that is defective in cystic fibrosis
- cyte (suffix)
- cytochrome P450 isozymes
- cytochromes.
- cytokine** Regulatory peptides that control cell development, differentiation, and the immune response
- inflammatory response
- virus, response to
- cytolytic agents
- cytoplasm** All material inside the cell membrane except for the nucleus
- of an axon
- of egg
- cytoplasmic bridges
- cytoplasmic protein fibers
- cytoplasmic receptor
- cytoplasmic resistance
- cytoplasmic side
- cytosine
- cytoskeleton** The internal scaffolding of the cell, composed of microfilaments, intermediate filaments, and microtubules
- cytosol** Semi-gelatinous intracellular fluid containing dissolved nutrients, ions, and waste products
- cytosolic calcium
- cytosolic mineralocorticoid (MR) receptor
- cytosolic receptor
- cytosolic ribosome
- cytotoxic T cell** A lymphocyte that kills its target cells
- cytotoxic cell response
- cytotoxic enzyme
- cytotoxic T cell (TC cell)
- D
- Δ^9 -*tetrahydrocannabinoid* (THC)
- Da. *See* Dalton's law
- DAG. *See* diacylglycerol
- dalton (Da)** 1 dalton = 1 atomic mass unit
- Dalton's Law** The total pressure of a mixture of gases is determined by the sum of the pressures of the individual gases
- data** Information or facts gathered during an experiment
- dB *See* decibel
- D cell** Pancreatic endocrine cell that secretes somatostatin
- DDP4 inhibitors
- dead space** Those portions of the respiratory system that do not exchange gases with the blood
- deamination** Removal of an amino group from a molecule
- death
- deci- (d) (prefix)
- decibel (dB)** Measure of sound wave intensity
- deciliter (dL)** 1/10 of a liter or 100 mL
- decision-making
- declarative memory** Memory that depends on the use of higher level cognitive skills such as inference, comparison, and evaluation. Synonym: explicit memory
- decomposition reaction
- deep sleep
- deep somatic pain
- defecation reflex
- defense mechanisms
- deflection
- degenerated myelin sheath
- degenerative disease
- deglutition** Swallowing
- degrade
- degraded hormones
- degranulation** Process in which immune cells release the contents of their granules
- dehydration
- diarrhea as a cause for
- homeostatic compensation
- homeostatic responses
- dehydration synthesis** Reaction in which two molecules are joined with the loss of a water molecule
- dehydroepiandrosterone (DHEA)
- deiodinase** Tissue enzyme that converts T4 to T3 by removal of an iodine
- delayed gastric emptying
- delayed hypersensitivity reaction** Allergic reaction mediated by T cells that may take several days to develop
- delivery
- delta (δ) isoform
- delta wave** High-amplitude, low-frequency brain waves of deep sleep
- dementia
- demyelinating disease** Disease in which myelin is destroyed, slowing the conduction of action potentials
- denaturation
- dendrite** Thin, branched processes that receive and transfer incoming information to an integrating region within the neuron
- dendritic cell** Antigen-presenting immune cells with long, thin processes
- dendritic spine** Projections of the dendrite membrane that increase surface area
- denervation hypersensitivity** Up-regulation of neurotransmitter receptors following denervation creates greater than expected response to exogenous neurotransmitter
- dense bodies** Attachment proteins for smooth muscle actin fibers
- dense connective tissues
- deoxygenated
- deoxyribonucleic acid. *See* DNA
- deoxyribose
- dependent variable** The Y-axis variable that is dependent on the manipulated or independent variable
- dephosphorylation
- depolarization** A decrease in the membrane potential difference of a cell
- autorhythmic cells
- conducting system of the heart
- stimulus
- depression
- depth of field
- dermis
- descending aorta
- descending arteries
- descending autonomic pathways
- descending colon
- descending limb of loop of Henle
- descending tract** Neurons that carry information from the brain to the spinal cord
- desensitization** Reversible form of receptor down-regulation achieved using modulators
- desmopressin** A form of vasopressin
- desmosome** A type of cell-to-cell junction
- detoxification
- deuterium
- dextran
- dextrose** A six-carbon sugar; also known as glucose
- DHEA. *See* dehydroepiandrosterone
- DHP receptor. *See* dihydropyridine (DHP) receptor
- DHT. *See* dihydrotestosterone
- diabetes insipidus** Disease characterized by lack of vasopressin
- diabetes mellitus** Disease characterized by lack of or abnormal action of insulin
- autoimmune diseases
- diagnosing
- diagnostic criteria
- drugs for treating
- hypoglycemia
- diabetic autonomic neuropathy** Disturbances of neuronal function as a complication of diabetes mellitus
- diabetic ketoacidosis *See also* ketoacidosis
- diabetic retinopathy
- diacylglycerol (DAG)** A second messenger
- diaphragm (muscle)** The skeletal muscle that forms the floor of the thoracic cage
- diaphysis** The shaft of a long bone

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- diarrhea** Excessive amounts of watery stool
- diastole** The time during which cardiac muscle relaxes
- diastolic pressure** Lowest pressure in the circulatory system, associated with relaxation of the ventricles
- dicarboxylate
- dicrotic notch
- diencephalon** Brain portion between brain stem and cerebrum, consisting of thalamus and hypothalamus
- diet
- dietary calcium
- dietary fat. *See also* lipid
- diet-induced thermogenesis** An increase in resting metabolic rate following a meal
- differential white cell count
- differentiation** Developmental process during which cells take on different forms and functions
- diffuse endocrine system** Hormones secreted by isolated endocrine cells
- diffuse lymphoid tissue
- diffuse modulatory system** Clusters of brain stem neurons that influence large areas of the brain
- diffusion** Movement of molecules from an area of higher concentration to an area of lower concentration
- experiment
- gas solubility affects
 - hypoxia, as a cause of
 - hypoxia and
 - placental membranes
- diffusion distance
- digested antigen
- digestion** Chemical and mechanical breakdown of foods into smaller units that can be absorbed
- and absorption
- fats
 - large intestine
 - small intestine
 - digestive enzyme
- digestive hormone
- digestive reflex
- digestive secretion
- digestive system** Those structures involved in ingestion, processing, absorption, and elimination of food
- absorption
- anatomy of the
 - cephalic phase
 - digestion
 - digestion and absorption
 - function and processes
 - gastric phase
 - GI function, regulation of
 - GI tract, immune functions of the
 - immune functions of the GI tract
 - integrated function
 - intestinal phase
 - ion and water secretion
 - ions and water
 - is a tube
 - mass balance
 - motility
 - overview of the
 - secretion
 - tube
 - digestive tract
- digitalis
- Digitalis purpurea*
- dihydropyridine (DHP) receptor** Voltage-sensing receptors in the t-tubules, linked to Ca^{2+} channels
- dihydrotestosterone (DHT)
- 1,25-dihydroxycholecalciferol. *See* calcitriol
- 1,25-dihydroxy-vitamin D^3 . *See* calciferol
- diiodotyrosine (DIT)
- dilute filtrate
- dilutional hyponatremia. *See also* hyponatremia
- dipalmitoylphosphatidylcholine** Surfactant in the alveoli that decreases surface tension
- dipeptide
- dipeptidyl peptidase
- 2,3-diphosphoglycerate (2,3-DPG)** A metabolite of red blood cells that lowers the binding affinity of hemoglobin for oxygen. Synonym: 2,3-bisphosphoglycerate (2,3-BPG)
- direct active transport. *See also* primary active transport
- direct calorimetry** A procedure in which food is burned and the heat released is trapped and measured
- disaccharidase** Enzyme that digests disaccharides
- disaccharide** Sugar composed of two sugar monomers
- disequilibrium
- disintegrating distal axon
- disk
- dissociation
- dissociation constant (K_d)
- dissociation curves
- dissociation factor
- distal
- distal end
- distal nephron** The distal tubule and collecting duct
- distal nephron Ca^{2+} reabsorption
- distal tubule
- distant source
- distension
- disulfide bond** A weak bond between two sulfur atoms
- DIT. *See* diiodotyrosine
- diuresis** Loss of water in the urine
- diuretic** A drug that causes water loss in the urine
- divalent metal transporter 1 (DMT1)
- divergence** A few presynaptic neurons branch to affect a larger number of postsynaptic neurons
- divergent pathway
- dL. *See* deciliter
- DNA (deoxyribonucleic acid)** Nucleotide that stores genetic information in the nucleus
- metabolism
- DNA molecule
- DNA synthesis
- docking protein** Membrane proteins that connect vesicles to the cell membrane for exocytosis
- dopamine (DA)** Amine CNS neurotransmitter
- dopaminergic
- dopaminergic (dopamine-secreting) neurons
- dorsal
- dorsal blood vessels
- dorsal body
- dorsal horn** Region of spinal cord that contains sensory nuclei
- dorsal respiratory group (DRG)** Medullary neurons that control normal inspiration
- dorsal root** Branch of a spinal nerve that carries sensory information
- dorsal root ganglion** A collection of sensory cell bodies found on the dorsal root just before it enters the spinal cord
- dorsal surface
- dorsal view
- double-blind crossover study** Double-blind experiment in which the subjects switch between experimental treatment and placebo halfway through the study
- double-blind study** Experimental design in which neither the subject nor the researcher knows who is getting the experimental treatment and who is getting the placebo
- double bond** Bonds formed when two atoms share two pairs of electrons
- double displacement reaction
- double helix, DNA
- down-regulation** Decrease in protein number or binding affinity that lessens response
- down the gradient, molecule diffusion
- drinking
- drinking behavior. *See also* water balance
- drives
- drug susceptibility
- drug tolerance
- D-serine
- Duchenne muscular dystrophy
- duct
- duct cell
- ductus deferens. *See* vas deferens
- ductus deferens
- duodenal cell
- duodenal ulcer. *See* peptic ulcer
- duodenum** Initial segment of the small intestine
- dura mater** Outer membrane of the meninges
- duration
- duration of action
- duration of muscle contraction
- dust particle
- dwarfism** A condition of short stature caused by inadequate growth hormone during childhood
- dynamic equilibrium** Equilibrium related to movement through space
- dynamite
- dynein** A motor protein
- dynorphins
- dyspepsia
- dysplasia
- dyspnea** A subjective feeling of not being able to breathe or get air
- dystrophin** Muscle protein that links actin to the cell membrane
- E
- ear
- artificial
 - auditory cortex
 - auditory pathway
 - cerebellum
 - cochlea
 - equilibrium
 - equilibrium pathways
 - head position
 - hearing
 - hearing loss
 - linear acceleration
 - mechanical damage
 - movement and position
 - neural damage
 - otolith organs
 - rotational acceleration
 - semicircular canals
 - sound
 - sound perception
 - sound transduction
 - sound transmission
 - vestibular apparatus

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- ear canal
- eardrum. *See also* tympanic membrane
- early follicular phase
- early ventricular diastole
- eating. *See* food intake
- eating behavior
- eating disorders. *See also* anorexia nervosa
- E-C coupling. *See* excitation-contraction coupling
- ECF. *See* extracellular fluid
- ECG. *See* electrocardiogram
- ECL cell. *See* enterochromaffin-like cell
- E. coli*. *See* *Escherichia coli*
- ecology
- ectohormone** Signal molecules secreted to the external environment
- ED. *See* erectile dysfunction
- edema** The accumulation of fluid in the interstitial space
- EDRF. *See* endothelial-derived relaxing factor
- EDV. *See* end-diastolic volume
- EEG. *See* electroencephalogram
- effector** The cell or tissue that carries out the homeostatic response
- effector cell
- effector organ
- efferent
- efferent arteriole
- efferent division
- efferent lymph vessel
- efferent neuron** A peripheral neuron that carries signals from the central nervous system to the target cells
- efferent output
- efferent pathway** Outgoing signal that goes from the integrating center to an effector
- efficiency
- efflux
- egg. *See also* ovum
- egg (secondary oocyte)
- eicosanoid** Modified 20-carbon fatty acids that act as regulators of physiological functions
- Einstein, Albert
- Einthoven's triangle** The triangle formed by the three lead electrodes of the simple ECG
- E_{ion} . *See* equilibrium potential
- E_{ion}
- ejaculation** Semen in the urethra is expelled to the exterior
- ejaculatory duct
- ejection fraction
- EKG. *See* electrocardiogram
- elastance** Ability of a stretched substance to return to its unstretched state
- elastase
- elastic arteries
- elastic component
- elastic connective tissue
- elastic fiber
- elastic recoil
- elastic systemic arteries
- elastic tissue
- elastin** A coiled, wavy protein that returns to its original length after being stretched
- electrical activity
- electrical charge
- electrical communication
- electrical conduction in myocardial cells
- electrical current
- electrical disequilibrium
- electrical event
- electrical gradient** Uneven distribution of electrical charge, especially across a membrane
- electrical signal. *See also* action potential; phototransduction
- ear
- eye
- heart
- electrical synapse** Synapse where electrical signals pass directly from cell to cell through gap junctions
- electricity
- electrocardiogram (ECG)** A recording of the summed electrical events of the cardiac cycle
- electrochemical gradient** The combined concentration and electrical gradients for an ion
- electrodes
- electroencephalogram (EEG)
- electroencephalography
- electrogenic pump
- electrolyte** An ion. *See also* ion electrolyte balance, *specific electrolyte*
- electromechanical coupling
- electron
- electron molecular bonds
- electron transport system (ETS)
- electrophoresis
- electrostatic attraction
- element** The simplest kind of matter, such as oxygen and carbon
- embryo
- embryological development. *See also* *specific structure*
- embryonic blood
- embryonic blood vessels
- embryonic development
- embryonic germ cells (SRY gene)
- emergent property** Some property of a system that cannot be predicted from the simple sum of its parts
- emesis** Vomiting
- emission** Movement of sperm from vas deferens to the urethra
- emotion
- emotional hyperventilation
- emotional states
- emotional stress
- emphysema
- emphysema** Lung disease characterized by loss of elastance and alveolar surface area
- emulsion** Small droplets suspended in a liquid
- E_{Na^+} . *See* equilibrium potential
- ENaC (epithelial sodium channel)
- encapsulated lymphoid tissue** Lymph nodes and the spleen
- enclosed nerve ending
- end-diastolic volume (EDV)** The maximum volume of blood that the ventricles hold during a cardiac cycle
- endergonic reaction** A reaction that requires net input of energy from an outside source
- endocrine cell
- hormones
- hormone release
- hypothalamic anterior pituitary pathway
- pituitary gland
- endocrine control
- endocrine gland** A ductless gland or single cell that secretes a hormone. *See also* endocrine system
- endocrine pathology. *See* endocrine system; endocrine system, disorders of
- endocrine pathway
- endocrine reflex
- endocrine system** The cells and tissues of the body that secrete hormones. *See also* *endocrine gland; specific gland*
- autonomic responses
- disorders of
- glands
- growth
- integrating center
- introduction to and metabolism
- pancreas
- principles, review of
- principles review
- endocrine system sensor-integrating center
- endocrinology. *See also* endocrine system
- endocytosis
- endogenous factor
- endogenous hormone
- endogenous precursor
- endolymph** High K^+ , low Na^+ fluid that fills the cochlear duct of the ear
- endolymphatic hydrops
- endometrium** The secretory inner lining of the uterus
- endopeptidase** An enzyme that attacks peptide bonds in the interior of an amino acid chain
- endoplasmic reticulum (ER)** A network of interconnected membrane tubes in the cytoplasm; site of protein and lipid synthesis
- endorphin
- endosome** Vesicle formed by endocytosis
- endostatin
- endothelial cell
- endothelial cell junction
- endothelial-derived relaxing factor (EDRF)** Nitric oxide released by endothelial cells; relaxes vascular smooth muscle. *See also* nitric oxide endothelial
- endothelial lining
- endothelin
- endothelium** Layer of thin epithelial cells that line the lumen of the heart and blood vessels
- atherosclerotic plaques
- bone marrow
- capillary exchange
- hematopoiesis
- platelet plug formation
- vasoconstriction
- endothelium-derived relaxing factor (EDRF)
- end-plate potential (EPP)** Depolarization at the motor end plate due to acetylcholine
- end-product inhibition. *See also* feedback inhibition
- end-systolic volume (ESV)** The amount of blood left in the ventricle at the end of contraction
- energy
- activation and reactions and ATP transfer in biological systems
- biological transport in the body requires body, balance in the capture and transfer cells and cellular metabolism
- chemical reactions
- conversions and enzymes
- fat and glycogen, storage in
- fats store
- input
- intake
- kinetic and potential
- lipid storage

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- energy (*Continued*)
 and metabolism
 and molecules during reactions
 output
 production
 during reactions
 requirements
 storage
 substrate
 thermodynamics
 transfer
 transfer and storage in biological reactions
 transfer in the environment
 use
 work and
- energy balance. *See also* metabolism
 energy-producing reaction. *See* catabolism; exergonic reaction
 energy production. *See* metabolism
 energy-utilizing reaction. *See* anabolism; endergonic reaction
 engorgement
 enhanced interneurons
 enkephalins
 ENS. *See* enteric nervous system
enteric nervous system Neurons in the wall of the gastrointestinal tract that are capable of sensing and integrating information and carrying out a response without input from the CNS
 enteric plexus
 enteric sensory neuron
enterochromaffin-like cell Stomach cells that secrete histamine
 enterocyte
enterokinase Old name for enteropeptidase
enteropeptidase Intestinal enzyme that activates trypsin
entropy A condition of randomness or disorder
 envelope
 environmental factor
 environmental stability. *See* homeostasis
 environmental stimuli
 environmental temperature
 enzymatic activity
 enzymatic breakdown
 enzymatic reactions
enzyme Protein catalysts that speed up reactions by lowering their activation energy
 activation energy of reactions
 activity
 defects
 diagnostically important
 digestive system
 disease related
 fertilization
 lower activation energy of reactions
 Lysosomal
 metabolism
 modulation
 neurotransmitter termination
 for protein digestion
 and proteins
 reaction
 reversibility of metabolic reactions
 secretion
 eosin
eosinophil Leukocytes associated with parasitic infections and allergic reactions
ependyma Epithelium that lines the brain ventricles and spinal canal
 ependymal cells
 ephemeral signal molecules
 epidermis
epididymis Duct from seminiferous tubules to vas deferens where sperm complete their maturation
 epiglottis
 epilepsy
epinephrine Catecholamine neurohormone secreted by the adrenal medulla
 efferent division-
 heart as a pump
 hormone interactions
epiphyseal plate Region of long bones where active bone growth takes place
epiphysis The end of a long bone
 epithelia
 protection and exchange, provide
 structure of
 transporting
 types of
 epithelial cell. *See also* epithelium
 epithelial milk-secreting cells
 epithelial Na^+ channel (ENaC)
 epithelial tissue
epithelial transport Movement of material from one side of an epithelium to the other
epithelium Tissue that protects surface of the body, lines hollow organs, and manufactures and secretes substances. *See also specific type, structure or organ*
 EPO. *See* erythropoietin
 EPP. *See* end-plate potential
 (EPSP) excitatory depolarization
 EPSPs. *See* excitatory postsynaptic potential
 eq. *See* equivalent
 equilibrium
 equilibrium constant K_{eq}
 equilibrium pathways
equilibrium potential (E_{ion}) The membrane potential that exactly opposes the concentration gradient of an ion
equivalent (eq) Molarity of an ion times the number of charges the ion carries
 ER. *See* endoplasmic reticulum
 erectile dysfunction (ED)
erection Blood trapped within spongy tissues of the penis causes it to lengthen and harden
 erection reflex
 erogenous zones
 ERV. *See* expiratory reserve volume
erythroblast A large, nucleated immature red blood cell
erythrocyte Red blood cells that transport oxygen and carbon dioxide between the lungs and the tissues
erythropoiesis Red blood cell production
erythropoietin (EPO) Hormone made in the kidneys that regulates red blood cell production
Escherichia coli
esophagus The passageway connecting the mouth and stomach
 essential amino acid. *See also* amino acid
essential amino acid Amino acids the human body cannot synthesize and must obtain from the diet
essential element Those elements necessary for life
essential hypertension High blood pressure whose cause is unclear
estradiol Form of estrogen produced when aromatase acts on testosterone
estrogen Steroid hormone produced in ovary and adrenal cortex; dominant steroid in females
 estrone
 ESV. *See* end-systolic volume
 ethics
etiology The cause or origin of a disease
eupnea Normal breathing
 eustachian tube
 evaporation
evaporative cooling (evaporative heat loss) Cooling that occurs when water evaporates from the skin's surface
 evaporative heat loss
 evidence-based medicine
 evolution
excess postexercise oxygen consumption (EPOC) Increased oxygen consumption following exercise that represents metabolism to replace ATP and other stores consumed during exercise
exchange epithelia Thin epithelia designed for easy transfer of material from one compartment to another. Examples are the alveoli and the endothelium
 exchange of gases
 exchange reaction
 exchangers
 exchange surface
 excitability
excitable tissue Neural and muscle tissue that is capable of generating and responding to electrical signals
 excitation
excitation-contraction coupling The sequence of action potentials and Ca^{2+} release that initiate contraction
 excitation-coupled Ca^{2+} entry
 excitatory
 excitatory input
 excitatory interneurons
 excitatory neuron
 excitatory neurotransmitter
excitatory postsynaptic potential (EPSPs) Depolarizing graded potentials that make a neuron more likely to fire an action potential
 excitatory synapses
excretion The elimination of material from the body at the lungs, skin, intestine, or kidneys
 metabolites for
 salts and H_2O in urine
 of wastes
 execution movement
 exempt
 exercise. *See also* muscle contraction
 baroreceptor reflex adjustment
 blood gases and
 blood pressure and
 cardiac output
 and cardiovascular disease
 cardiovascular disease and
 cardiovascular response to
 and diabetes
 energy substrate use during
 factors limiting
 feedforward response to
 glucose tolerance improvement
 and health
 and immune function
 immune function and
 insulin secretion improvement
 intensity
 limiting factors
 metabolism and
 muscle blood flow increases

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oxygen consumption
and stress
stress and the immune system
temperature regulation during
type 2 diabetes mellitus
ventilatory responses to

exercise hyperventilation An increase in ventilation that accompanies an increase in metabolic rate.
Synonym: hyperpnea

exergonic reaction Chemical reaction that releases energy

exhaled air
exocrine cell

exocrine gland A gland that releases secretions into the external environment through ducts

exocrine pancreas
exocrine secretion

exocytosis Process in which intracellular vesicles fuse with the cell membrane and release their contents into the extracellular fluid

epithelial transport
exocytosis of vesicles
exogenous

exon Segment of a gene that encodes a protein

exopeptidase Enzymes that release single amino acids from peptides by chopping them off the ends

exophthalmos Bulging eyes in hyperthyroidism due to enlargement of tissue in the eye socket

expectorated
experiment
experimental control. *See* control

expiration The movement of air out of the lungs

expiratory muscles The abdominal muscles and internal intercostals

expiratory reserve volume (ERV) The amount of air that can be exhaled after the end of a normal expiration

explicit memory. *See* declarative (explicit) memory

expressive aphasia Inability to speak coherently as a result of damage to Broca's area

extension

extensor A muscle that moves bones away from each other when the muscle contracts ,

external anal sphincter
external change
external ear

external environment The environment surrounding the body. *See also* extracellular fluid

external genitalia
external heat input
external input
external intercostals

external lamina Thin matrix layer supporting nerve and muscle cells

external lenses
external receptor

external respiration The interchange of gases between the environment and the body's cells *See also* breathing; gas exchange

external signal
external sphincter
extracellular bacteria
extracellular bath
extracellular buffer
extracellular enzyme

extracellular fluid (ECF) The internal fluid that surrounds the cells
of central nervous system. *See* cerebrospinal fluid
digestive system

epithelial transport
heart, as a pump
hormones
ion concentrations and equilibrium potentials
membrane transporters
osmolarity
sodium-potassium pump
steady state
vasoconstriction
volume

extracellular fluid volume and blood pressure, regulation of
extracellular ligands
extracellular matrix
extracellular signal molecule
extraembryonic membrane
extrafusal fiber

extrafusal muscle fiber The normal contractile fibers of a muscle

extraocular muscle
extrapyramidal influence

extrapyramidal tract or system Neural network associated with basal ganglia that influences body position and movement

extravasation
extrinsic eye muscle
extrinsic neuron

extrinsic pathway Coagulation pathway that starts when damaged tissues expose tissue factor

eye, . *See also* photoreceptors
electrical signals
external anatomy of the lens
light
optics of the photoreceptors
phototransduction
pupil
retina
sagittal section
sensory pathways
signal processing
skull
eyelids
eye movement

F

F. *See* Faraday constant
F₁F₀ ATPase. *See* ATP synthase
F1 upward force
F2 downward rotational force

fab region The antigen-binding arms of an antibody molecule

facial nerve

facilitated diffusion Movement of molecules across cell membranes in response to a concentration gradient with the aid of a membrane protein

F-actin Long chains or filaments of actin molecules

factor General name given to signal molecules when first discovered

factor II. *See* fibrin
factor III. *See* thrombin
factor IV. *See* calcium
factor IX. *See* tissue factor
factor V
factor VII
factor VIII
factor X

factor XI
factor XII
FAD (flavin adenine dinucleotide)

Fallopian tube Tube that transport eggs from the ovary to the uterus

Fallopian
far-sightedness

Fas A "death receptor" on cell membranes whose activation causes a cell to commit suicide by apoptosis

fascicles

fast axonal transport Rapid movement of particles along an axon using microtubules and kinesin foot proteins

fasted state. *See* postabsorptive state
fasted-state metabolism
fasting. *See also* postabsorptive state
fasting plasma glucose

fast pain Sharp, rapidly transmitted pain

fast synaptic potential Graded potential in postsynaptic cells that begins quickly and lasts only a few milliseconds

fast-twitch fiber Muscle fibers that develop tension rapidly

fast-twitch glycolytic fiber Fast muscle fibers that rely on anaerobic metabolism and therefore fatigue rapidly

fast-twitch glycolytic muscle
fast-twitch muscle

fast-twitch oxidative-glycolytic fiber Fast muscle fibers that use a combination of aerobic and anaerobic metabolism and therefore do not fatigue as fast as glycolytic fibers

fast-twitch oxidative glycolytic muscle
fat. *See also* adipose tissue; lipid
abdominal
digestion
metabolism
by simple diffusion
stores
synthesis
fat cell. *See* adipocyte

fatigue, muscle Inability of a muscle to continue to generate or sustain tension

fatigue resistance

fatty acid Long chain of carbon atoms bound to hydrogens and terminating with a carboxyl

fatty acid metabolism
fatty acid synthetase Enzyme for fatty acid synthesis
fatty streak

F cell Pancreatic endocrine cell that secretes pancreatic polypeptide

Fc region Stem of antibody molecule that binds to receptors on immune cells

Fe²⁺. *See* iron
feces

fed state. *See* absorptive state
fed-state metabolism
feedback
feedback cycle

feedback inhibition The end product of a metabolic pathway acts as an inhibitory modulator of the pathway.
Synonym: end-product inhibition

feedback loop Information about a homeostatic response that is sent back to the integrating center

feedback pathways
feedback patterns
feedforward

feedforward control Anticipatory responses that start a response loop in anticipation of a change that is about to occur

feedforward mechanism

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- feedforward postural reflexes
 feedforward reflex
 feedforward responses
 feeding. *See* food intake
feeding center Tonically active hypothalamic center that promotes food intake
 female embryonic development
 female gametogenesis
 female reproduction
 female secondary sex characteristics, hormones and female sex organs
 female-specific genes
fenestrated capillary Capillary with large pores in the endothelium
 fenestrated pores
ferritin Protein that binds and stores iron in the body
 ferroportin
 fertility-awareness methods
 fertilization
 fetal hemoglobin (HbF)
 fetus
 fever
 FG. *See* fast-twitch glycolytic fibers
 FGF. *See* fibroblast growth factor
 fiber
 fibrillation
 fibrillin
fibrin Plasma protein that forms polymer fibers that stabilize platelet plugs
 fibrin fragment
fibrinogen Plasma protein that becomes fibrin in blood clots
 fibrinolysin. *See* plasmin
fibrinolysis Dissolution of fibrin by plasmin
 fibrin polymer
 fibrin production
 fibrin-stabilizing factor (XIII)
 fibrin thread
 fibroblast
 fibroblast growth factor (FGF)
 fibroblast-like reticular cells
fibronectin A protein fiber that helps connect cells to their extracellular matrix
 fibrosis
 fibrotic lung diseases
 fibrous protein
 fibrous scar tissue
 fibrous shape
 fibrous skeleton
 fibrous tissue
 Fick, Adolph
 Fick equation
Fick's law of diffusion Diffusion through a membrane is directly proportional to the surface area and concentration gradient and inversely proportional to the thickness of the membrane and its resistance
 fight-or-flight response
 figure legend
 filtrate
filtration Bulk flow of plasma-like fluid from the glomerular capillaries into Bowman's capsule
 barrier
 capillary pressure causes
 coefficient
 glomerular filtration rate
filtration fraction The percentage of total plasma volume that filters at the glomerulus
filtration slit Opening between podocyte foot processes through which renal filtration takes place
fimbriae The fringed opening of the Fallopian tube
 fine touch
first heart sound Sounds created by vibrations from closure of AV valves
first law of thermodynamics Energy in the universe is constant
first messenger Chemical signal molecules released by cells
 first-order neuron
 first polar body
 fistula
5-alpha-reductase Enzyme that converts testosterone to DHT
 five carbon sugars (pentoses)
 5-HT. *See* serotonin
 5-hydroxytryptamine. *See* serotonin
 fixation point
 fixed ribosomes
 flaccid
 flaccid paralysis
flagella Long hair-like extensions of the cell whose microtubules create movement
flatus Intestinal gas
flavin adenine dinucleotide (FAD) Molecule that captures and transfers energy with high-energy electrons
 Fleming, Alexander
 flexible membrane
 flexible region
 flexion
flexion reflex A polysynaptic reflex that causes an arm or leg to be pulled away from a painful stimulus
flexor A muscle that brings connected bones closer together when it contracts
 flow *See also* flow rate; gas laws
 flow back
 flow charts
 flowing fluid
 flow out
flow rate The volume of blood that passes one point in the system per unit time
 fluid
 absorbed
 absorption
 alveolar gas exchange, influenced by amount of
 balance
 compartment
 and electrolyte balance
 and electrolyte homeostasis
 flow
 homeostasis
 intake
 loss
 loss and drinking
 in motion
 movement
 pressure
 secretion
 volume
 waves
 fluid and electrolyte balance. *See also specific electrolyte ;*
 water balance
 fluid balance. *See also* water balance
 fluid-filled inner ear
fluid mosaic model Membrane composed of phospholipid bilayer with proteins inserted wholly or partially into the bilayer
fluid pressure Pressure created by the presence of fluid within an enclosed space. *See also* hydrostatic pressure
 flutter
 flux
 foam cell
focal adhesion Junction between intracellular actin and matrix proteins
focal length (focal distance) The distance from the center of a lens to the focal point
focal point The point where parallel light waves passing through a lens converge
 FOG. *See* fast-twitch oxidative-glycolytic fibers
 follicle, ovarian
 follicle colloid
 follicle stage
follicle-stimulating hormone (FSH) Anterior pituitary hormone that stimulates gamete production in the gonads
 follicular cells
 follicular development
follicular phase Phase of the menstrual cycle during which ovarian follicles mature and prepare to release an egg
 food intake
foot process Long cytoplasmic extension of a podocyte that wraps around glomerular capillaries
 force
 force (tension)
 force calculations
 force of muscle contraction
 forebrain
 foreign material
 foreign substances
 foreign tissue
 foreskin
 fornix
 forward reaction
 fourth ventricle
fovea The region of most acute vision and the point on which light is focused when you look at an object
 fragments
 Framingham Heart Study
 Frank, Otto
Frank-Starling law of the heart The principle that within physiological limits, the heart will pump all the blood that returns to it
free energy The amount of energy stored in the chemical bonds of a molecule and available to perform work
 free fatty acid pool
 free fatty acids (FFA)
 free nerve endings
free radical Unstable molecule with one more unpaired electrons
 free ribosome
 frequency
frequency coding The frequency of action potentials encodes the intensity of a stimulus
 frequency of action potentials
 fresh air
 friction rub
 frontal bone
 frontal lobe
 fructose
 FSH (follicle-stimulating hormone)
 fulcrum
 fulcrum system
 function
 functional compartment
functional group Groups of atoms that tend to move from molecule to molecule as a single unit
 functional magnetic resonance imaging (fMRI)
 functional residual capacity
functional unit The smallest structure that can carry out all the functions of a system
fundus The upper portion of the stomach

Glossary/Index

- funny current
furosemide
fused basement membrane
fusion pore Membrane complex through which secretory vesicle contents can be released
- G
GABA. *See* gamma-aminobutyric acid
GABA (gamma-amino butyric acid)
G-actin Single globular molecule of actin
G-actin molecule
gait
galactose A hexose monosaccharide
Galen, Claudius
Galen of Pergamum
gallbladder Organ that stores and concentrates bile
GALT. *See* gut-associated lymphoid tissue
gamete The reproductive cells that unite to form a new individual
gametogenesis Gamete production
 γ -aminobutyric acid. *See* gamma-aminobutyric acid
gamma (γ) isotope
gamma-aminobutyric acid (GABA) Inhibitory neurotransmitter of the CNS
gamma globulin Name given to the immune globulins of plasma *See also* antibody
gamma motor neuron Small neuron that innervates intrafusal fibers within the muscle spindle
gamma (γ) radiation High energy waves that penetrate matter deeply, like x-rays
ganglia
ganglion A cluster of nerve cell bodies in the peripheral nervous system
ganglion cells Neurons of the eye whose axons form the optic nerve
ganglionic synapse
gap junction Cytoplasmic bridges between adjacent cells, created by linked membrane proteins
gas composition
gas diffusion
gas equation
gases
concentration gradients, diffuse down
 relative contribution
 in solution
gas exchange. *See also* gas transport
 in the alveolar
 in the alveoli
 in the lungs
 in the lungs and tissues
 pulmonary
 in the tissues
 transport
gas laws
gas solubility
gas transport
gastric acid (HCl)
gastric acid secretion
gastric emptying
gastric function
gastric gland
gastric inhibitory peptide (GIP)
gastric juice pH ~ 2
gastric lipase Stomach enzyme that digests lipids
gastric motility
gastric mucosa
gastric mucous cells
gastric phase
gastric phase secretion
gastric secretions
gastric smooth muscle
gastrin Hormone secreted by the stomach that stimulates gastric acid secretion
gastrin (G cells)
gastrin family
gastrin-releasing peptide
gastrocolic reflex
gastroesophageal reflux
gastroesophageal reflux disorder (gerd)
gastroileal reflex
gastrointestinal
gastrointestinal motility
gastrointestinal system
gastrointestinal tract (GI tract) Synonym: digestive tract hormones
 lumen
 motility
 patterns of contraction
 peptide
 smooth muscle
 spontaneous contractions
 stem cells
 wall
 gastrointestinal tract (GI tract). *See also* digestive system
gate control model
gate control theory
gated channel A channel that opens and closes in response to stimuli. *See also* ligand-gated ion channel; voltage-gated channels
gated ion channel
G cell Cell of the stomach that secretes gastrin
GDH. *See* glutamate dehydrogenase
GDP. *See* guanosine diphosphate
gelatinous cupula
gelatinous otolith membrane
gene A region of DNA that contains all the information needed to make a functional piece of mRNA
gene activation
gene activity
General Adaptation Syndrome The body's response to stress
general interpretive center
generic membrane proteins
genetically engineered hGH
genetically inherited abnormal receptors
genetic code
genetic sex
genetic sex determination
gene transcription
genitalia The external reproductive structures. *See also specific structure*
genome
genomic effect Any effect that occurs due to altered gene activity
genomics
germ cell Embryonic gonadal cells that produce gametes
gestation. *See also* pregnancy
gestational diabetes mellitus
GFR. *See* glomerular filtration rate
GH. *See* growth hormone
GHIH (growth hormone-inhibiting hormone).
 See somatostatin
GHK equation. *See* Goldman-Hodgkin-Katz (GHK) equation
ghrelin
GHRH. *See* growth hormone-releasing hormone
giant axon
giantism
Gilman, Alfred G.
GIP (gastric inhibitory peptide) GI hormone that causes feedforward release of insulin
GI tract. *See* digestive system; gastrointestinal tract
gland Group of epithelial cells specialized for synthesis and secretion of substances
 accessory
 endocrine
 glandular epithelium
glandular organ
glandular secretion
glans
glans penis
glaucoma
glia. *See* glial cell
glial cells Nonexcitable support cells of the central nervous system
glial support cell
globin
globular protein
globular shape
globulin
glomerular capillary
glomerular capillary endothelium
glomerular filtration Movement of fluid from the glomerulus into the lumen of Bowman's capsule.
 See also glomerular filtration rate
glomerular filtration rate (GFR) The amount of fluid that filters into Bowman's capsule per unit time
autoregulation
hormones and autonomic neurons influence on
 and peripheral blood pressure
 relatively constant
glomeruli
glomerulus Ball-like network of capillaries in the kidney; site of filtration
glomus cell Cells of the carotid and aortic body that respond to low oxygen
glossopharyngeal
glossopharyngeal nerve
glottis
GLP-1. *See* glucagon-like peptide
glucagon Pancreatic hormone that elevates plasma glucose
 biosynthesis
 cell of origin
 chemical nature
 factors affecting release
 feedback regulation
 half-life
 molecular level, action at
 plasma glucose levels
 target cells or tissue
 target receptor/second messenger
 transport in the circulation
 whole body or tissue action
glucagon secretion
glucocorticoids Adrenal steroid hormones such as cortisol that elevate plasma glucose
glucokinase Enzyme that phosphorylates glucose
gluconeogenesis Pathways through which noncarbohydrate precursors, especially amino acids, are converted into glucose
glucose A six-carbon sugar that is a major energy source for the body. Synonym: dextrose
 aerobic metabolism of
 cellular utilization and storage

Glossary/Index

- glucose** (*Continued*)
 digestive system
 epithelial transport
 and insulin
 metabolism
 reabsorption
 tolerance tests
 transport
 utilization
 vesicular transport
- glucose (CHO)
 glucose 6-phosphate
 glucose clearance
 glucose-dependent insulinotropic peptide
 glucose metabolism
 glucose molecule
 glucose oxidation
 glucose polymer
 glucose tolerance
 glucose tolerance test
 glucose transport
 glucose transporter. *See* GLUT transporter
- glucostatic theory** Theory that glucose utilization by the hypothalamic centers regulates food intake
- glucosuria (glycosuria)** Excretion of glucose in the urine
- glutamate** Amino acid that also acts as an excitatory neurotransmitter
- glutamate dehydrogenase (GDH)
 glutamine
 glutaminergic ionotropic (iGluR)
 glutaminergic metabotropic (mGluR)
 glutire
- GLUT transporter** Family of facilitated diffusion carriers for glucose and other hexose sugars
- glycerol** A simple 3-carbon molecule that is the backbone of fatty acids
- glycine** Amino acid that also acts as an inhibitory neurotransmitter
- glycocalyx** Glycoproteins on the surface of cells
- glycogen** Storage polysaccharide found in animal cells
- granules
 stores
 synthesis
- glycogenesis** The synthesis of glycogen from glucose
- glycogenolysis** The breakdown of glycogen
- glycolipid** Molecule that is a combination of carbohydrate and lipid
- glycolysis
- glycolysis** Metabolic pathway that converts glucose to pyruvate (aerobic) or lactic acid (anaerobic)
- glycoprotein** Molecule that is a combination of carbohydrate and protein
- glycoprotein coat
- glycosuria. *See also* glucosuria
- glycosylated molecule** A molecule that has sugar molecules attached to it
- glycosylphosphatidylinositol (GPI)
 GnRH
 GnRH (gonadotropin-releasing hormone)
 GnRH pulse generator
- goblet cell** Single exocrine cell that produces mucus
- goiter** Enlarged thyroid gland
- Goldman-Hodgkin-Katz (GHK) equation** Calculates resting membrane potential using membrane permeability and ion concentrations gradients
- G_{olf}** G protein for olfactory transduction
- Golgi, Camillo
 Golgi apparatus
- Golgi apparatus** Organelle that modifies and packages proteins into vesicles
- Golgi tendon organ** Receptors are found at the junction of the tendons and muscle fibers that respond to both stretch and contraction of the muscle
- Golgi tendon reflex
- gonad** The organs (ovaries and testes) that produce gametes
- gonad (bipotential)
 gonad (cortex)
 gonad (medulla)
- gonadotropin (FSH and LH)** Peptide hormone from the anterior pituitary that acts on the gonads
- gonadotropin level
- gonadotropin-releasing hormone (GnRH)** Hypothalamic hormone that stimulates release of gonadotropins from the anterior pituitary
- goose
 gout
- GPCR. *See* G protein-coupled receptor
- GPCR-adenylyl cyclase signal transduction and amplification
 GPCR-camp pathways
 GPCR-phospholipase C signal transduction
 GPI (glycosylphosphatidylinositol) anchor
- G protein** Membrane proteins that couple membrane receptors to ion channels or membrane enzymes
- G protein-coupled adenylyl cyclase-cAMP system** The first signal transduction system discovered
- G protein-coupled membrane receptor
 G protein-coupled receptor
 G protein-coupled receptors (GPCR)
 G protein-coupled signal transduction
- graded contraction** Muscle contraction whose force varies with the amount of Ca²⁺ that enters the cell
- graded potential** A change in membrane potential whose magnitude is proportional to the stimulus and that decreases with distance as it spreads through the cytoplasm
- sensory transduction
 graft
- gram molecular mass** The weight of one mole of a substance, expressed in grams
- granular cells** Specialized cells in the walls of renal arterioles that synthesize and release renin
- granulocyte** White blood cell whose cytoplasmic inclusions give it a granular appearance: basophils, eosinophils, and neutrophils
- granulosa cell** Cell of the ovarian follicle that secretes estrogen
- granzyme** Enzyme of cytotoxic T cells that triggers apoptosis in target cells
- graphs
- Graves' disease** Hyperthyroid disorder caused by TSH-like antibodies
- gravitational force
 gravity
- gray matter** Nerve cell bodies, dendrites, and axon terminals
- gross anatomy
 ground
- ground substance** A cellular portion of matrix consisting of glycoproteins and water. *See also* matrix
- growth. *See also* matrix
 and aging
 anterior pituitary hormones affecting. *See* growth hormone
 charts
- factor
 growth cone
- growth hormone** Protein hormone from the anterior pituitary that controls tissue growth
- anterior pituitary
 biosynthesis
 cellular level
 ethical questions
 factors affecting
 genetically engineered
 half life
 is anabolic
 and normal growth
 origin
 pathway
 secretion
 target cell
 target receptor
 tissue reaction
 transport
 growth hormone-binding protein
 growth hormone control pathway
 growth hormone-inhibiting hormone (GHIH) *See also* somatostatin
- growth hormone-releasing hormone (GHRH)**
 Hypothalamic hormone that influences growth hormone secretion
- GTP. *See* guanosine triphosphate
- guanosine diphosphate
 guanylyl cyclase Enzyme that controls formation of cyclic GMP
- guanylyl cyclase activity
 guanylyl cyclase-linked receptor-enzymes
- Guillain-Barré syndrome** Rare autoimmune paralytic neural condition with loss of both sensory and motor function
- Guillemin, Roger
 gustation. *See also* taste
 gustatory cortex
 gustatory neurons
 gustducin
- gut-associated lymphoid tissue (GALT)** Immune cells and tissues of the GI tract
- gut contents
- gyrus** Convolution of cerebral surface
- H
 H⁺. *See* hydrogen ion
 H⁺-ATPase. *See* hydrogen ATPase
 H⁺-K⁺-ATPase
 H₂ receptor
 H₂S. *See* hydrogen sulfide
 H zone
- habituation** A decreased response to a stimulus that is repeated over and over
- hair
hair cell Sensory cells for transduction of sound and equilibrium
 hair follicles
 hair movement
 hair root
 Haldane, John
half-life The amount of time required to reduce the concentration of hormone by one-half
 hamstring muscle
 hand
 HAPE. *See* high-altitude pulmonary edema
 hard palate

Glossary/Index

- Harvey, William
- haustra** Bulging pockets of the large intestine wall
- Hb. *See* hemoglobin
- HbA (hemoglobin A)
- HbA₂ (hemoglobin A₂)
- HbF (hemoglobin F/fetal hemoglobin)
- HbO₂. *See* oxyhemoglobin
- HbS** (hemoglobin S) Abnormal hemoglobin of sickle cell disease
- hCG. *See* human chorionic gonadotropin
- HCL (parietal cells)
- HCN channel. *See* hyperpolarization-activated cyclic nucleotide-gated channel
- HCO₃⁻. *See* bicarbonate ion
- hCS (human chorionic somatomammotropin). *See* human placental lactogen
- HDL. *See* high-density lipoprotein
- HDL-C. *See* high-density lipoprotein-cholesterol
- head
- head movement
- head position
- health and exercise
- hearing
- hearing loss
- heart** Muscular organ that serves as the pump for the circulatory system, . *See also terms under cardiac*
- cardiovascular system
- conducting system of the
- electrical events
- embryo
- hormones
- and major blood vessels
- one-way flow
- skeletal muscle pump
- structure of the
- vasoconstriction
- Wiggers diagram
- heart attack. *See* myocardial infarction
- heartbeat
- heart contraction
- heart disease. *See also* myocardial infarction
- heart failure
- heart muscle
- heart rate
- heart sounds
- heart valve** Connective tissue valves that prevent back flow of blood in the heart
- heat
- heat exhaustion
- heat index** Synonym: humidex
- heat loss
- heat production
- heat stroke
- heavy chain
- helicobacter pylori
- helicotrema
- helper T cell** Immune cells that secrete cytokines to help other immune cells
- hematocrit** Percentage of the total blood volume that is packed red blood cells
- hematopoiesis** Blood cell production in the bone marrow
- hematopoietic stem cell
- heme
- heme group** A carbon-hydrogen-nitrogen porphyrin ring with an iron atom in the center
- heme production
- hemidesmosome** Strong junction that ties a cell to matrix hemisphere
- hemoglobin** Oxygen-carrying pigment of red blood cells
- adult
- affinity for oxygen
- binding properties
- CO₂
- CO₂ transport
- fetal
- and hydrogen ion
- maternal
- molecules
- oxygen, binds to
- oxygen is transported in blood dissolved in plasma or bound to
- oxygen transport. *See also* oxygen binding
- red blood cells with
- saturation
- spleen, breakdown products from the
- synthesis
- transport, oxygen to tissues
- hemoglobin A_{1c}
- hemoglobin binding. *See* oxygen binding
- hemoglobin S** (HbS) Abnormal hemoglobin of sickle cell disease
- hemolytic anemias
- hemophilia
- hemorrhage** Excessive blood loss
- hemostasis** Process of keeping blood within the blood vessels by repairing breaks without compromising the fluidity of the blood
- Henderson-Hasselbalch equation
- Henle, loop of. *See* loop of Henle
- heparin** An anticoagulant molecule
- hepatic artery
- hepatic gluconeogenesis
- hepatic portal system** Specialized region of the circulation that transports material absorbed at the intestine directly to cells of the liver
- hepatic portal vein
- hepatic vein
- hepatocyte** Liver cell
- hepcidin
- hereditary anemia
- hereditary spherocytosis
- Hering-Breuer inflation reflex** Reflex to prevent over-inflation of the lungs
- hermaphrodites
- herpes simplex type 1
- hertz (Hz)** Measure of sound wave frequency
- hexokinase
- hexokinase-mediated conversion
- hexosaminidase A** Enzyme whose absence causes Tay-Sachs disease
- hexose** A six-carbon sugar
- hGH. *See* growth hormone
- HGP. *See* Human Genome Project
- HIF-1. *See* hypoxia-inducible factor
- high-acuity
- high altitude
- high-altitude cerebral edema
- high-altitude pulmonary edema (HAPE)
- high-density lipoprotein (HDL)** The "good" plasma carrier for cholesterol
- high-density lipoprotein-cholesterol (HDL-C)
- high-energy bond
- high-energy electron
- high-energy phosphate bond
- higher brain center
- higher brain control
- higher center modulation
- high frequency
- Hillary, Edmond
- hindbrain
- hinge region
- hippocampus** Portion of the brain associated with learning and memory
- Hippocrates
- histamine** Paracrine secreted by mast cells and basophils; acts as a vasodilator and bronchoconstrictor
- breathing, mechanics of
- digestive system
- immune response
- vasoconstrictor
- histiocyte** Old name for skin macrophages
- histogram** Graph that quantifies the distribution of one variable over a range of values
- histology** The study of tissue structure and function
- HLA. *See* human leukocyte antigen
- HMG CoA reductase
- Hodgkin, A. L.
- homeo- (prefix)
- homeodynamics
- homeostasis** The ability of the body to maintain a relatively constant internal environment
- digestive system
- local control and
- reflex control and
- homeostatic
- homeostatic reflex pathways
- homeostatic responses
- homeothermic** Mammals and birds that maintain relatively constant body temperature
- homo- (prefix)
- homocysteine
- homunculus
- horizontal canal
- horizontal cell
- hormonal treatments
- hormone** Chemical secreted by a cell or group of cells into the blood for transport to a distant target where it acts in very low concentrations to affect growth, development, homeostasis, or metabolism. *See also specific type*
- action termination
- adrenal gland
- amine
- amino acid-derived
- amino acids, derived from single
- antagonistic
- blood, secretion into the
- blood, transport by
- calcium balance control
- chemical
- classification
- concentration effect
- cortisol pathologies as a result of too much or too little
- deficiency
- digestive system
- degraded
- endocrine system
- evolution
- excess
- half-life
- hypersecretion effect on
- hypothalamic-anterior pituitary
- pathway
- inhibiting
- interactions

Glossary/Index

hormone (Continued)

kidney filtration
 male reproduction
 menstrual cycle, control of the metabolism
 metabolism regulation
 ovary production of eggs and pancreatic islet cells
 peptide
 permissive
 placenta secretion of
 portal system delivery
 pregnancy, during
 release, control of
 releasing
 secondary sex characteristics, influence female
 secretion
 steroid
 synthesis
 target, transport to a distant
 target cell receptors, bind to
 thyroid
 tissue growth requires
 trophic
 vasoconstrictor
 water and solutes permeability

hormone receptor
 hormone-receptor complex
 hormone replacement therapy (HRT)
 hormone-response element
 host cell
 Howard Hughes Medical Institute (HHMI)
 HPA pathway. *See* hypothalamic-pituitary-adrenal (HPA) pathway
 hPL. *See* human placental lactogen
 HPO_4^{2-} . *See* phosphate ion
 HPV vaccine
 HRT. *See* hormone replacement therapy
human chorionic gonadotropin (hCG) Hormone secreted by the developing placenta
 human chorionic somatomammotropin (hCS)
 human chromosome
 human embryo
 human evolution
 human experiments
 Human Genome Project
 human immunodeficiency virus (HIV)
human leukocyte antigen (HLA) Name for classification of human MHC proteins
 human papillomavirus (HPV)
 human pheromone
human placental lactogen (hPL) Peptide placental hormone that influences maternal metabolism. Synonym human chorionic somatomammotropin (hCS)
 human sexual response, four phases of
 human studies
 humid air
 humidex
 humoral
humoral immunity Immunity conferred by antibodies. *See also* antibody
 humors
 humor therapy
 hunger
 Huxley, A. F.
hydraulic pressure Pressure exerted by fluid in motion. Uses synonymously with hydrostatic pressure in the circulatory system
 hydrogen ATPase
hydrogen bond Weak attractive forces between hydrogens and other atoms, especially oxygen and nitrogen

hydrogen ion
 hydrogen ion concentration
 hydrogen ion input
 hydrogen ion secretion
 hydrogen sulfide (H_2S)
hydrolysis Reaction in which large molecules are broken into smaller ones by addition of water
 hydrolysis reaction
 hydrophilic amino acids
 hydrophilic interactions
hydrophilic molecule Molecules that dissolve readily in water
 hydrophobic
 hydrophobic barrier
 hydrophobic interactions
hydrophobic molecule Molecules that do not dissolve readily in water
 hydrophobic steroids
hydrostatic pressure The pressure exerted by a stationary column of fluid in a tube
hydroxyapatite Calcium phosphate crystals of bone
 β -hydroxybutyric acid
 25-hydroxycholecalciferol ($25(\text{OH})\text{D}_3$)
 11 β -hydroxysteroid dehydrogenase
 hymen (maidenhead)
 hyperbilirubinemia
 hypercalcemia
hypercapnia Elevated P_{CO_2} in the blood
 hypercholesterolemia
 hypercortisolism (Cushing's Syndrome)
 hyperemia
 hyperglycemia. *See also* diabetes mellitus
 hyperglycemic hyperosmolar state
 hyperinsulinemia
 hyperkalemia
 hyperkalemic periodic paralysis (hyperKPP)
 hyperKPP. *See* hyperkalemic periodic paralysis
hyperopia Far-sightedness
 hyperosmotic
 hyperosmotic solution
 hyperparathyroidism
hyperplasia Increased cell number due to cell division
hyperpnea Increase in ventilation rate to match an increase in metabolic rate. Synonym: exercise hyperventilation
hyperpolarization A membrane potential that is more negative than the resting potential
 hyperpolarization-activated cyclic nucleotide-gated channel
 hyperpolarize
 hypersecreting tumor
 hypersecretion
 hypersensitivity
hypertension Chronically elevated blood pressure
 hyperthermia
 hyperthyroid
 hyperthyroidism
hypertonic solution A solution that causes net movement of water out of a cell
hypertrophy An increase in cell size without an increase in cell number
 hyperuricemia
hyperventilation An increase in alveolar ventilation that is not associated with an increase in metabolic rate
 hypocalcemia
 hypocalcemic tetany
 hypochromic
 hypocortisolism
 hypocretins
 hypodermis
 hypoglossal
 hypoglycemia

hypokalemia
 hypokalemic periodic paralysis
 hyponatremia
 hypoprolactinemia
 hyposecretion
 hyposmotic
 hyposmotic fluid
 hypotension
 hypothalamic–anterior pituitary pathway
 hypothalamic feeding center
 hypothalamic growth hormone–releasing hormone (GHRH)
hypothalamic-hypophyseal portal system Modified section of the circulation that takes neurohormones directly from the hypothalamus to the anterior pituitary
 hypothalamic inhibiting hormone
 hypothalamic mechanisms
 hypothalamic neurons
 hypothalamic osmoreceptors
 hypothalamic-pituitary-adrenal (HPA)
 hypothalamic-pituitary-adrenal (HPA) pathway
 hypothalamic-pituitary control system
 hypothalamic-pituitary pathway
 hypothalamic releasing hormone
 hypothalamic thermoregulatory center
hypothalamus Region of the brain that contains centers for behavioral drives and plays a key role in homeostasis
 brain, anatomy of the
 dehydration
 diffuse modulatory systems
 emotions, effect on physiology
 growth hormone
 hormone release, control of
 natriuretic peptides
 Renin-angiotensin System (RAS)
 sensory information
 thyroid hormone control pathway
 thyroid pathologies
 volume and osmolarity
hypothermia Low body temperature
 hypotheses
 hypothyroid
 hypothyroidism
hypotonic solution A solution that causes a net influx of water into a cell
 hypotonic medium
hypoventilation A decrease in alveolar ventilation without a change in metabolic rate
 hypovolemic shock
hypoxia Lack of oxygen in the cells
 cell
 classification
 classification of and diffusion problems
 pathologies that cause
 hypoxia-inducible factor 1 (HIF-1)
 hypoxic hypoxia
 Hz. *See* hertz
H zone Region of sarcomere with only thick filaments
 I
 I
iatrogenic condition Physician-caused condition
I band Region of the sarcomere occupied only by thin filaments
 ICC. *See* interstitial cells of Cajal
 I cell. *See* intercalated cell
 ICF. *See* intracellular fluid
 IDDM. *See* type 1 diabetes mellitus
 idea
 ideal gas law. *See* gas law
 identical subjects

Glossary/Index

- I_v channel** Monovalent cation channels in cardiac autorhythmic cells that contribute to the pacemaker potential
- IFN- α . *See* interferon-alpha
- IFN- β . *See* interferon-beta
- IFN- γ . *See* interferon-gamma
- Ig. *See* immunoglobulin
- IgA
- IgA antibodies
- IgD
- IgE
- IGF. *See* insulin-like growth factor
- IgG
- IgM
- Ignarro, Louis
- interleukins (IL)
- I_{ion}
- IL. *See* interleukin
- ileocecal valve** Muscular region whose contraction separates the large and small intestines
- ileum** Distal portion of the small intestine
- image distance
- immediate hypersensitivity reaction** Allergic reaction that occurs within minutes
- immediate response
- immune activity
- immune cell
- immune function
- immune response
- immune surveillance** Theory that cancer cells develop regularly but are usually detected and destroyed by the immune system
- immune system** The cells and tissues and their products that defend the body against invaders
- and abnormal cell
- acquired immunity, antigen-specific responses
 - anatomy of the
 - cells of the
 - and exercise
 - function, and stress
 - immune response
 - immune response pathways
 - innate immunity, nonspecific response
 - lymphatic system
 - neuro-endocrine-immune interactions
 - overview of
 - pathogens of the human body
 - recognize "self"
- immunity** The ability of the body to protect itself from pathogens
- immunocyte** General name given to any of the immune cells
- immunodeficiency diseases
- immunogens
- immunoglobulin** Synonym for antibody
- immunoglobulin superfamily cams
- immunologic memory
- immunosuppressant effects
- impermeable membrane** A membrane that does not allow substances to cross
- implantation
- implicit memory. *See* reflexive (implicit) memory
- impotence
- inactivating bacterial toxin
- inactivation
- inactivation gate** The slow gate of the Na⁺ channel that closes to stop ion flow
- inactive MLCK
- inactive pathway
- inactive plasma protein
- inactive region
- inactive rhodopsin
- inclusion** Particle of insoluble material in the cytoplasm such as glycogen granules and lipid droplets
- incoming signal
- incontinence** Inability to voluntarily control urination or defecation
- increased GFR (transient)
- increased osmolarity
- increasing potential difference
- incretin
- incretin (GLP-1) analogs
- incus** Middle of the three small bones of the middle ear
- independent variable** The parameter manipulated by the investigator in an experiment; graphed on the x-axis
- indirect (secondary) active transport
- indirect active transport
- indirect calorimetry** Estimation of metabolic rate by measuring oxygen consumption
- induced-fit model of protein-ligand activity** The active site changes shape to fit either substrate or product molecules
- induced gene
- inelastic ligaments
- inertia
- infantile spasm
- infection
- inferior vena cava** Great vein that returns blood from the lower body to the right atrium
- infertility** Inability to conceive
- inflammation** A nonspecific reaction of the immune system to a foreign invader
- inflammatory
- inflammatory bowel diseases
- inflammatory pain
- inflammatory response
- inflatable cuff
- inflation pressure
- information
- information exchange
- information flow
- information input
- information processing
- information storage
- infundibulum
- ingestion
- inguinal lymph nodes
- inhaled pathogens
- inheritance
- inhibin** Peptide hormone from the gonads that inhibits FSH secretion ,
- inhibiting hormone
- inhibiting interneuron
- inhibition
- inhibitor
- inhibitory
- inhibitory hyperpolarization
- inhibitory interneuron
- inhibitory modulation
- inhibitory neuron
- inhibitory neuron synapses
- inhibitory neurotransmitters
- inhibitory postsynaptic potential (IPSP)** Hyperpolarizing graded potentials that make a neuron less likely to fire an action potential
- inhibitory presynaptic neuron
- inhibitory synapses
- initial repolarization
- initial segment** The axon hillock and first part of an axon; often the location of the neuron's trigger zone
- initiation of movement
- initiation of repair
- innate immunity** The nonspecific responses of the body to invasion by foreign substances
- innate reflexes
- inner cell mass
- inner ear** Portion of the ear containing the cochlea and hair cells
- inner mitochondrial membrane
- innervated** Controlled by a neuron
- inositol trisphosphate (IP3)** A second messenger made from membrane
- inotropic agent** Any chemical that affects contractility
- input
- input (afferent) signal
- input (metabolic production)
- input pathway
- input signal
- insensible water loss** Water loss across the skin and in exhaled air of which we are not normally aware
- insertion of a muscle
- insoluble fibers
- insomnia** Inability to sleep well
- inspiration** The movement of air into the lungs
- inspiratory
- inspiratory capacity
- inspiratory muscles** The external intercostals, diaphragm, scalenes, and sternocleidomastoids
- inspiratory neuron** Somatic motor neurons controlling the inspiratory muscles
- inspiratory reserve volume (IRV)** The volume of air that can be inhaled in addition to a normal inspiration
- inspired air, composition of
- insulin** Pancreatic hormone that decreases plasma glucose concentration
- insulin-dependent diabetes mellitus. *See* type 1 diabetes mellitus
- insulin-like growth factors (IGFs)
- insulin-receptor substrates (IRS)
- insulin resistance
- insulin-resistant diabetes. *See* type 2 diabetes mellitus
- insulin secretion
- insulin-sensitive cell
- insulin therapy
- insulin-to-glucagon ratio
- intake
- integral protein
- integrated control of volume and osmolarity
- integrated function
- integrated information
- integrated membrane processes
- integrating center** The control center that evaluates incoming signal and decides on an appropriate response
- integration
- integrin** Membrane-spanning proteins that link the cytoskeleton to extracellular matrix proteins
- integrin receptor
- integumentary system. *See also* skin
- intensity
- interacting hormone
- intercalated cell (I cell)** Cell of the collecting duct that transports H⁺ and bicarbonate

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- intercalated disk** Specialized cell junctions in cardiac muscle that contain gap junctions
- intercellular cement
- interconnecting neurons. *See* interneuron
- intercostal muscles** Muscles associated with the rib cage; used for breathing
- intercostal nerve
- interference
- interferon-alpha (IFN- α)
- interferon-beta (IFN- β)
- interferon-gamma (IFN- γ)
- interferon** Cytokines secreted by lymphocytes
- integration of resistance
- interleukin (IL)** Cytokines released by one type of white blood cell to act on another
- intermediary metabolism
- intermediate filament** Cytoplasmic protein fiber made of myosin, keratin, neurofilament, and other proteins
- intermediate hormone
- intermembrane space** Region between the two outer membranes of a mitochondrion
- internal body temperature
- internal change
- internal environment** The extracellular fluid that surrounds the cells of the body. *See also* extracellular fluid; homeostasis
- internal environmental stimuli
- internal genitalia
- internal heat production
- internal intercostals
- internal jugular vein
- internal organization
- internal organs
- internal sphincter
- internal stability
- internal structure
- internal uterus
- International Commission on Radiological Protection
- internet resources
- interneuron** A neuron that is completely contained within the central nervous system
- to hypothalamus
- inhibiting somatic motor neuron
- internodal pathway** Conduction pathway from the SA node to the AV node
- interpolate
- interstitial cells of Cajal (ICC)** Modified smooth muscle cells of the digestive tract that appear to initiate slow waves
- interstitial fluid** Extracellular fluid that surrounds the cells and lies between the cells and the plasma
- digestive system
- interstitial tissue
- interstitium
- intervals
- interventional methods
- intestinal absorption
- intestinal Ca²⁺ absorption
- intestinal cell
- intestinal crypt cell
- intestinal enzyme
- intestinal gland
- intestinal glucose uptake
- intestinal lumen
- intestinal mucosa
- intestinal phase
- intestinal secretion
- intestinal smooth muscle
- intestinal tract
- intestinal transport
- intestine
- calcium balance
- digestive hormones
- epithelial transport
- hormones
- lumen of
- vitamins and minerals, absorption of
- intima
- Into Thin Air* (Krakauer, Jon)
- intracellular
- intracellular compartments. *See also specific type*
- intracellular defense
- intracellular enzymes
- intracellular fluid (ICF)** Fluid within the cells
- ion concentrations and equilibrium potentials
- steady state
- volume
- intracellular glucose
- intracellular messenger
- intracellular nucleic acid protein complexes (antinuclear antibodies)
- intracellular pathways
- intracellular receptor proteins
- intracellular recording
- intracellular response
- intracellular signal
- intracellular signal molecules
- intracellular signal receptors
- intracellular transport
- intrafusal fiber** Modified muscle fibers of the muscle spindle that lack myofibrils in their central portions
- intraocular
- intrapleural pressure** Pressure within the pleural fluid
- intravenous (IV) injection
- intravenous solutions
- intrinsic enteric neurons
- intrinsic factor** Protein secreted by gastric parietal cells that is required for vitamin B₁₂ absorption in the intestine
- intrinsic neurons
- intrinsic pathway** Coagulation reaction that begins with collagen exposure and uses proteins already present in plasma
- intrinsic protein. *See* transmembrane protein
- intrinsic rate
- intron** Non-coding segments of DNA within a gene
- inulin** A polysaccharide isolated from plants; used to determine extracellular fluid volume and glomerular filtration rate
- inulin clearance
- in utero
- in vitro** Experiments performed "in glass"
- in vitro fertilization** Fertilization of an egg outside the body
- in vitro motility
- in vivo
- involuntary functions
- iodinated amine
- iodine
- iodine atoms
- ion** An atom with a net positive or negative charge due to gain or loss of one or more electrons
- absorption
- crypt cells secrete water and digestive system secretion
- electrical signals
- intestine absorption of
- membrane attack complex
- signal transduction
- paracellular movement
- and water
- water and solutes permeability ion channel
- ion concentration gradient
- ion concentrations
- ion electrolyte balance
- ion flow
- ionic bond** A bond between ions attracted to each other by opposite charge
- ion movement
- ionotropic receptor** Neurotransmitter receptor that alters ion channel function
- ion permeab
- ion permeability (Pion)
- ion reabsorption
- IP
- IP₃. *See* inositol trisphosphate
- IP₃-receptor-channel** Ca²⁺ channels in smooth muscle sarcoplasmic reticulum that open in response to IP₃
- ipsilateral** On the same side as
- IPSP. *See* inhibitory postsynaptic potential
- inhibitory hyperpolarization
- iris
- iron
- iron atom
- iron deficiency
- iron-deficiency anemia
- iron transport
- irreversible antagonists
- irreversible inhibitor
- irreversible reaction
- irritable bowel syndrome
- irritant receptors** Stimulated by inhaled particles or noxious gases in the airway mucosa
- irritants
- irritating substances
- IRS. *See* insulin-receptor substrates
- IRV. *See* inspiratory reserve volume
- ischemia** Lack of adequate blood flow and oxygen to a tissue
- ischemic hypoxia
- islet cells
- islets of Langerhans** Clusters of endocrine tissue within the pancreas
- isoform** Related forms of a molecule
- isometric contraction** A contraction that creates force without movement
- isoproterenol
- isosmotic
- isosmotic fluid
- isotonic contraction** A contraction that creates force and moves a load
- isotonic solution** A solution that results in no net water movement when a cell is placed in it
- isotope** Atoms of the same element that have different numbers of neutrons
- isotropic
- isovolumic relaxation
- isovolumic ventricular contraction** Phase of the cardiac cycle when the ventricles are contracting but all valves are closed and the volume of blood in them is not changing
- isovolumic ventricular relaxation** Phase of the cardiac cycle when the ventricles are relaxing but the volume of blood in them is not changing
- isozyme** Related forms of a single enzyme
- issue number
- itch
- itch (pruritus)
- IUD. *See* intrauterine device

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ivabradine
IV fluid therapy. *See* intravenous (IV) injection

J

JAK kinase
Janus family tyrosine kinase
jaundice A yellow tint to the skin and sclera due to excessive levels of bilirubin
“java jolt”
jejunum The middle section of the small intestine
JG cells (granular)
joint
joint receptor Sensory receptors that send information about the relative positioning of bones linked by flexible joints
juvenile-onset diabetes. *See also* type 1 diabetes mellitus
juxtaglomerular (JG) apparatus Region where the distal tubule of the nephron passes between afferent and efferent arterioles
juxtamedullary nephrons
K
K⁺. *See* potassium ion
kallikrein
K_{ATP} channel. *See* ATP-gated K⁺ channel
kcal. *See* kilocalorie
K_d. *See* dissociation constant
K_{eq}. *See* equilibrium constant
keratin Insoluble protein prevalent in hair and nails
ketoacidosis A state of acidosis that results from excessive ketone production
ketoacids
ketogenesis
ketogenic
ketone bodies
ketone production
ketones
ketosis
key
kidney
 adrenal gland
 ammonia and phosphate buffers, use of
 calcium balance
 conserve volume
 epithelial transport
 excretion
 filter
 filtration
 H⁺ secretion
 hormones
 natriuretic peptides
 pH homeostasis depends on
 pituitary gland
 reabsorption
 salt and water excretion
 secretion
 structure of the tubular elements
 urinary system
 vasoconstrictor
 water balance
 water conservation
 kidney cell
kidney function
killer T cell. *See* cytotoxic T cell
kilocalorie (kcal or Calorie) Amount of energy needed to raise the temperature of 1 liter of water by 1° C
kinase An enzyme that adds a phosphate group to the substrate
kinesin A motor protein
kinetic energy The energy of motion

kinin
kinocilium
kiss-and-run pathway Secretion in which the secretory vesicle fuses transiently with the membrane, then pulls away
kisspeptin
knee jerk
knockout mouse A mouse whose DNA has been altered to remove (“knock out”) a specific gene
knowledge
Korotkoff sound
Krebs, Hans A.
Krebs cycle. *See also* citric acid cycle
kwashiorkor
kyphosis
L
labeled line coding The 1:1 association of a sensory receptor with a sensation
labia majora Outer lips of the vulva
labia minora Small inner lips of the vulva
labioscrotal swelling
labium majus
labium minus
labor
labor and delivery
lack of response
lacrimal apparatus Tear ducts and glands
lacrimal gland
lactase Enzyme that breaks down the milk sugar lactose
lactate
lactate accumulation
lactate dehydrogenase (LDH)
lactation Milk production by the mammary gland
lacteal A fingerlike projection of the lymph system that extends into the villi of the intestine
lactic acid The end product of anaerobic glycolysis
lactic acidosis
lactic acid production
lactose Milk sugar
lactose intolerance
lamina propria Subepithelial connective tissue that holds the epithelium in place
laminin Insoluble protein fiber in extracellular matrix
Langerhans cell Alternate name for dendritic cell
language
language processing
LaPlace, law of Pressure of a fluid sphere equals 2 times the surface tension of the fluid divided by the radius of the sphere
large intestine The terminal portion of the intestine
larynx The “voice box” that contains vocal cords
latch state
late diastole
latent period Delay between the muscle action potential and beginning of muscle tension that represents the time required for Ca²⁺ release and binding to troponin
lateral corticospinal tract
lateral dimension of rib cage
lateral geniculate body/nucleus Nucleus in the thalamus where optic fibers synapse with neurons going to the visual cortex
lateral horn
lateral inhibition Process in which sensory neurons close to a stimulus are inhibited to intensify the perception of the stimulus
lateral neurons

lateral ventricles
late ventricular diastole
law of conservation of electrical charge The body is electrically neutral
law of conservation of energy The total amount of energy in the universe is constant. Also called the first law of thermodynamics
law of LaPlace. *See* LaPlace, law of
law of mass action For a reaction at equilibrium, the ratio of substrates to products is always the same
law of mass balance If the amount of a substance in the body remains constant, any gain must be offset by an equal loss
LDH. *See* lactate dehydrogenase
LDL-cholesterol. *See* low-density lipoprotein (LDL)
L-dopa Dopamine precursor that can cross the blood-brain barrier
leads
leak channel Ion channels that spend most of their time in an open state
leaky epithelia Epithelia that allow movement between the cells
leaky junctions
learned reflex
learning
Le Châtelier’s principle. *See also* law of mass action
left atrium Chamber of the heart that receives blood from the lungs
left ventricle Chamber of the heart that pumps blood to the systemic circulation
legs
length constant
lengthening (eccentric) contraction
length-force relationship
length-tension relationship
lens Portion of the eye that focuses light upon the retina
lens curvature
leptin Protein hormone from adipocytes that acts as a satiety factor
lesion
let-down reflex Neuroendocrine reflex that triggers oxytocin release and ejection of milk from the mammary gland
leukemia
leukocyte White blood cells that defend the body against foreign invaders
leukopoiesis
leukotriene Eicosanoid signal molecule; plays a role in the etiology of asthma
levels of organization
levers
lever system
Leydig cell Testicular cells that secrete testosterone
LH. *See* luteinizing hormone
LHRH. *See* luteinizing hormone releasing hormone
libido Sex drive
lifeblood
ligament Connective tissue that connects one bone to another
ligand The molecule that binds to a protein
ligand-gated ion channel Synonym: chemically gated ion channel
light
 absorption
 bipolar cell
 transduction. *See also* phototransduction
light chain (myosin) Small protein chains that make up part of the smooth muscle myosin head

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- light-off (OFF bipolar cells)
 light-on (ON bipolar cells)
 light rays
 limb
limbic system Region of the cerebrum that acts as the link between higher cognitive functions and more primitive emotional responses
 line graph
lipase Enzyme that digests lipids
 lipase secretion
lipid Synonym: fats
 lipid-anchored protein
 lipid bilayer
 lipid core
 lipid-derived
 lipid-derived second messengers
 lipid layer
 lipid layer composition
 lipid raft
 lipid-related molecule
 lipid solubility
 lipid-soluble paracrine
 lipid-soluble substance
 lipogenesis
lipolysis Lipid breakdown
lipophilic molecules Molecules that can diffuse through cell membranes
 lipophilic signal molecule
lipophobic molecules Molecules that cannot diffuse through the phospholipid bilayer
lipoprotein Protein combined with a lipid
lipoprotein lipase Enzyme that digests lipoproteins
liposome Spherical structures with an exterior composed of a phospholipid bilayer, leaving a hollow center with an aqueous core
lipostatic theory Control of food intake is based on a set point for body weight that is set by adipocytes
 lipotropin
lipoxygenase Enzyme that converts arachidonic acid to leukotrienes
 liver
 bile secretion
 calcium balance
 cardiovascular system
 digestion
 gluconeogenesis
 growth hormone
 hepatic portal system
 metabolism
 muscle contraction
 liver bile
 liver cell
 liver disease
 liver glycogen
 liver hepatocyte
 liver protein
 living conditions
load A weight or force that opposes contraction of a muscle
 load-velocity relationship
 lobes of glandular tissue
 lobule
 local communication
local control Homeostatic control that takes place strictly at the tissue or cell by using paracrine or autocrine signals
 local control mechanisms
- local current flow** A wave of electrical current that spreads throughout the cytoplasm
 local signal
 locomotor pattern generator
 locus coeruleus
 long-distance communication
 long-distance pathway
 long-distance signaling
 longitudinal layer (tenai coli)
 longitudinal muscle
 longitudinal studies
 long-loop feedback
long-loop negative feedback Negative feedback from a peripheral endocrine gland hormone to the hypothalamus and anterior pituitary
 long QT syndrome (LQTS)
long reflex A GI reflex that is integrated in the CNS rather than in the enteric nervous system
 long-term depression (LTD)
 long-term energy storage
 long-term memory
long-term potentiation (LTP) Physical changes in a synapse that allow the response of the postsynaptic cell to a constant stimulus to be enhanced
loop of Henle Portion of the renal tubule that creates dilute urine and sets up the conditions needed to make concentrated urine
loose connective tissue Elastic connective tissues that underlie skin and provide support for small glands
 loose platelet plug
 loudness
 Lou Gehrig's disease. *See* amyotrophic lateral sclerosis (ALS)
 low blood pressure
 low current flow
low-density lipoprotein (LDL) The "bad" protein carrier for plasma cholesterol
 low-density lipoprotein-cholesterol (LDL-C)
 Lower, Richard
 lower esophageal sphincter
 lower eyelid
 lower respiratory system
 lower respiratory tract
 low frequency
 low oxygen blood
 LQTS. *See* long QT syndrome
 LTD. *See* long-term depression
 LTP. *See* long-term potentiation
 L-type calcium channel
 lumbar
 lumbar lymph node
 lumbar puncture
 lumbar spinal nerve
lumen The cavity of a hollow tube or organ
 of blood vessel
 of collecting duct
 digestive enzymes secretion
 of digestive tract
 of distal nephron
 fats in the
 of intestine
 pancreas
 of seminiferous tubule
 of the small intestine
 stomach
 of stomach
 luminal fluid
- lung(s)** Organs where gases are exchanged with the blood
 alveoli
 base
 cardiac notch
 CO₂ diffusion
 collapse
 in disease state
 exchange of air between the atmosphere and the
 external respiration
 gas exchange in the
 hypoxia, pathologies that cause
 inferior lobe
 inflation
 lobule
 middle lobe
 pH homeostasis depends on
 pleural sacs
 protective reflexes guard the
 pulmonary function tests
 at rest
 restrictive lung disease
 subatmospheric pressure in the pleural cavity
 superior lobe
 surface tension (T)
 water loss
lung capacity Sums of two or more lung volumes
 lung compliance
 lung elastance
 lung volume
 luteal cell
luteal phase The portion of the menstrual cycle following ovulation, when the corpus luteum produces estrogen and progesterone
luteinization Conversion of the follicle to a corpus luteum
luteinizing hormone (LH) Anterior pituitary hormone that acts on the gonads to influence hormone production
 luteinizing hormone releasing hormone
 luteinizing hormone surge
lymph The fluid within the lymphatic system that moves from the tissues to the venous side of the systemic circulation
 lymphatics of lower limb
 lymphatics of mammary gland
 lymphatics of upper limbs
 lymphatic system
 lymphatic vessel
lymph capillary Small vessels of the lymph system
 lymph duct
 lymph fluid
lymph node Collections of immune cells that monitor the lymph for pathogens
lymphocyte A white blood cell responsible primarily for the acquired immune response. *See also* B lymphocyte;
 T lymphocyte
 lymphocyte clone
 lymphocyte stem cell
 lymphoid nodule
 lymphoid organ
lymphoid tissues The tissues of the immune system, including the thymus gland, bone marrow, lymph nodes, and spleen. *See also* lymphatic system
 lymph vessel
 lysosomal enzyme
 lysosomal storage disease
 lysosome
lysozyme Antibacterial enzyme found in respiratory tract secretions and tears

Glossary/Index

M

M. *See* molarity

Macbeth (Shakespeare, William)

macromolecule

macrophage Tissue phagocytes that develop from monocytes
macrophage cytokine

macula Sensory receptors of the utricle and saccule of the
vestibular apparatus

macula densa Specialized cells in the distal tubule wall that
monitor fluid flow through the tubule

magnocellular ganglion cell (M cell)

maintenance

maintenance of ion balance

major essential element

major histocompatibility complex (MHC) Family of
membrane protein complexes that participate
in the immune response; play a role in foreign
tissue rejection

male accessory glands The prostate gland, bulbourethral
gland, and seminal vesicles

male condom

male embryonic development

male gametogenesis

male infertility. *See also* infertility

male reproduction

male sex act

male sex organs

malignant hyperthermia

malleus The first bone of the middle ear that sits against the
tympanic membrane

malnutrition

maltase Enzyme that digests the disaccharide maltose

maltose A disaccharide composed of two glucose molecules

mammary gland The exocrine glands of the breast

MAO. *See* monoamine oxidase

MAP. *See* mean arterial pressure

mapping

Maris, Roger

mass action, law of For a reaction at equilibrium, the ratio
of substrates to products is always the same

mass balance

mass balance, law of If the amount of a substance in the
body remains constant, any gain must be offset by
an equal loss

mass flow Mass flow equals concentration times volume flow

mass movement Wave of contraction in the large intestine
that triggers defecation

mass of atom

mast cell A tissue cell that secretes histamine

mastication Chewing

maternal blood

maternal blood vessels

maternal hemoglobin

matrix (extracellular matrix) Extracellular material
synthesized and secreted by cells

matrix metalloproteinases Enzymes that dissolve
extracellular matrix

matter

maximal rate of oxygen consumption (O₂max)

maximum voluntary ventilation The maximum speed and
depth at which a person can voluntarily breathe

McArdle's disease

M cell (1) Magnocellular ganglion cells in the retina that
transmit information about movement, location,
and depth perception; (2) Modified intestinal
epithelial cell overlying a Peyer's patch; absorbs
intestinal contents by transcytosis

mean arterial pressure (MAP) Average blood pressure in
the arteries, estimated as diastolic pressure plus
one-third of the pulse pressure. *See also* blood
pressure

mean blood pressure

mean corpuscular hemoglobin Average amount of
hemoglobin in one red blood cell

mean diameter

mean red cell volume (MCV)

mean systemic blood pressure

mean wall thickness

mechanical digestion

mechanical event

mechanically gated channel A channel that opens in
response to mechanical stimuli such as pressure
and heat

mechanical properties

mechanical stimuli

mechanical vibration

mechanical work

mechanics

mechanics of breathing

mechanisms

mechanistic approach The ability to explain the mechanisms
that underlie physiological events

mechanoreceptor A sensory receptor that responds to
mechanical energy such as touch or pressure

mediated transport Movement across a membrane with the
aid of a protein transporter

medicine. *See also specific medications*

medulla oblongata Portion of the brain stem that contains
centers for breathing, cardiovascular control,
swallowing, and other unconscious or involuntary
functions

central nervous system–

digestive system

hearing

nephrons

neurons in the

sodium balance

urinary system

medullary cardiovascular control center

medullary centers

medullary chemoreceptor

medullary interstitial fluid

medullary interstitial osmolarity

medullary interstitium

megakaryocyte Parent cell of platelets, found in bone
marrow

megalin Caveolar receptor for renal protein reabsorption

meiosis Cell division that produces haploid gametes

meiotic division

Meissner's corpuscle

Meissner's plexus. *See also* submucosal plexus

melanins

melanin granule

melanin synthesis

melanocortin receptors (MCRs)

melanocytes Pigment-containing cells that skin color in
humans and coat color in rodents

melanocyte-stimulating hormone (MSH)

melanoma

melanopsin (mRGCs)

melanopsin retinal ganglion cell

melatonin Hormone secreted by the pineal gland

melatonin secretion

membrane (1) the phospholipid bilayer that surrounds cells
and divides the cytoplasm into compartments,
or (2) a thin sheet or connective. *See also* cell
membrane; tissue membrane

action potentials

depolarization

repolarization

simple diffusion across a

T-cell receptors

transport across. *See also* carrier protein; channel protein

membrane attack complex Proteins produced by immune
cells that create membrane pores in the target cells

membrane carbohydrate

membrane channel

membrane defect

membrane disk

membrane dynamic

membrane enzyme

membrane hyperpolarization

membrane lipid

membrane modification

membrane permeability

membrane phospholipid

membrane pore protein

membrane potential difference The electrical potential
created by living cells due to uneven distribution
of ions between the intracellular and extracellular
fluids. *See also* resting membrane potential

in cardiac and skeletal muscle

cardiac autorhythmic cells

cardiac muscle fiber

membrane potential terminology

membrane processes

membrane protein. *See also specific type*

membrane receptor

membrane receptor protein

membrane recycling Process in which cell membrane is
withdrawn by endocytosis and stored as vesicles in
the cytoplasm until needed. At that time, the vesicle
is reinserted into the membrane by exocytosis

membrane-spanning proteins Membrane proteins that
are tightly bound into the phospholipid bilayer.
Synonyms: integral proteins or trans-membrane
proteins

membrane surface area

membrane thickness

membrane transporter

membrane transport processes

membranous organelle

memory

memory B cell

memory cell Lymphocytes responsible for creating stronger
and more rapid immune response following second
exposure to an antigen

memory processing

memory T cell

menarche A woman's first menstrual period

Ménière's disease An inner ear condition characterized by
dizziness, ringing, and nausea

meninges Three layers of membrane that lie between the
spinal cord and vertebrae, or brain and skull

Glossary/Index

- menopause** The time when a woman's menstrual cycles cease
- menses. *See also* menstruation
- menstrual cycle** The cyclic production of eggs and cyclic preparation of the uterus for pregnancy in females
- menstruation** Cyclic sloughing of the endometrial lining mEq. *See* milliequivalent
- Merkel receptor** Skin receptor for steady pressure
- mesangial cell** Contractile cells in the renal corpuscle that alter glomerular blood flow
- mesencephalon. *See also* midbrain
- mesentery** Peritoneal membrane that hold the intestines in place
- messenger RNA (mRNA)** RNA produced in the nucleus from a DNA template; travels to the cytoplasm to direct the synthesis of new proteins
- meta-analysis** Statistical technique that combines data from multiple studies to look for trends
- metabolic
- acid-base disturbances
 - metabolic acidosis** State of acidosis resulting from overproduction of metabolic acids
 - metabolic alkalosis** State of alkalosis usually resulting from loss of gastric acid through vomiting or excessive ingestion of alkaline antacids
 - metabolic CO₂ production
 - metabolic energy. *See also* metabolism; midbrain
 - metabolic enzymes
 - metabolic heat production
 - metabolic ketoacidosis
 - metabolic pathway regulation
 - metabolic pathway. *See also* metabolism
 - metabolic production
 - metabolic rate
 - metabolic reactions
 - metabolic removal
 - metabolic requirements
 - metabolic syndrome
 - metabolic vasodilators
 - metabolic waste
- metabolism** All the chemical reactions in the body
- enzymes control the direction of
 - and exercise
 - fasted-state
 - fed-state
 - homeostatic control of
 - hormones
 - insulin. *See also* diabetes mellitus
 - and movement, produce heat
 - muscle
 - nutrient pools and
 - vasoconstriction
- metabolite
- metabotropic receptor** Neurotransmitter receptor that acts through a second messenger system
- metarteriole
- metastasis** Spread of cancer or another disease throughout the body
- methylation** Addition of a methyl group
- Mg²⁺. *See* magnesium (Mg²⁺)
- mGluR
- MHC. *See* major histocompatibility complex
- MHC class II molecules
- MHC class I molecules
- MHC class I target cells
- MI. *See* myocardial infarction
- micelle** Small droplet of phospholipid, arranged micelle so that the interior is filled with hydrophobic fatty acid tails
- micro- (μ) (prefix)
- microcirculation** The arterioles, capillaries and venules
- microcytic
- microcytic red blood cells
- microfilament** Thinnest protein fibers in the cytoplasm, made of the protein actin
- microglia** Macrophages in the CNS
- microRNA
- microtubule** Tubular fibers made of the protein tubulin
- microtubule network
- microtubule-organizing center
- microvilli** Finger-like extensions of the cell membrane that increase the surface area for absorption of material
- micturition** Urination
- midbrain
- middle ear
- migrating motor complex** Contractions that move food remnants and bacteria from the stomach to the large intestine between meals
- milk duct
- milk ejected
- milk secretion
- milli- (m) (prefix)
- milliequivalent (mEq)
- millimeters of mercury (mm Hg)
- millimole
- mimetic** A substance that mimics another substance
- mind-body therapeutics
- mineralocorticoid. *See also* aldosterone
- mineralocorticoid receptors (MRs)
- minerals
- Minkowski, Oscar
- minor essential element. *See also* trace element
- minor essential elements
- minute volume. *See also* total pulmonary ventilation
- miRNA. *See* microRNA
- MIT. *See* monoiodotyrosine
- mitochondria** Organelles that generate ATP through oxidative phosphorylation
- mitochondrial DNA
- mitochondrial matrix** Central region of a mitochondrion
- mitochondrial spiral
- mitochondrial uncoupling
- mitochondria of varicosity
- mitochondrion
- mitosis** Cell division that results in two identical diploid daughter cells
- mitral valve. *See also* bicuspid valve
- mixed nerve** A nerve that carries both sensory and motor information
- mixing by segmentation
- MLCK. *See* myosin light chain kinase
- MLCP. *See* myosin light chain phosphatase
- M line** Sarcomere proteins to which myosin filaments attach
- mm Hg. *See* millimeters of mercury
- MMP. *See* matrix metalloproteinases
- modality** The nature of a stimulus
- model
- modifiable risk factor
- modulation
- modulation of signal pathway
- modulation of target cell response
- modulator
- modulatory pathway
- mol. *See* mole
- molarity (M)** Solution concentration expressed as moles of solute per liter of solution
- mole (mol)** 6.02×10^{23} atoms, ions, or molecules of a substance. Avogadro's number of particles
- molecular biology
- molecular bond. *See also* bond, chemical
- molecular chaperone** Protein that helps a newly-made protein fold into shape
- molecular complementarity** The physical compatibility of a ligand and its binding site
- molecular function
- molecular interaction. *See also specific type*
- molecular mass** The mass of one molecule, expressed in atomic mass units or daltons
- molecular model
- molecular shape
- molecular size
- molecular weight
- molecule** Two or more atoms linked together by sharing electrons
- and bonds
- chemotaxins
 - covalent bonds between atoms create
 - membrane transport
 - net movement
 - polar and nonpolar
 - single nucleotide
 - uncharged
- moles of gas
- monoamine oxidase (MAO)** The enzyme that breaks down norepinephrine
- monocular zone** The portion of the visual field where vision is two-dimensional
- monocyte** Blood cell that is the parent cell of tissue macrophages
- monoglyceride
- monoiodotyrosine (MIT)
- mononuclear phagocyte system
- mononuclear phagocyte system** Monocytes in the blood and tissue macrophages
- monosaccharide** Simple sugars such as glucose
- monosynaptic reflex** Reflex in which there is one synapse between neurons
- monosynaptic stretch reflex
- monounsaturated fatty acid** Fatty acid with one double bond
- monovalent
- monovalent cation channel
- mood** Relatively stable feelings related to sense of well-being
- more negative
- motile
- motilin** GI hormone that stimulates the migrating motor complex
- motility
- motivation
- motoneuron. *See* efferent neuron; motor neuron
- motor area
- motor association area
- motor cortex
- motor domain
- motor end plate**
- motor information
- motor nerves
- motor neuron. *See also* efferent neuron
- motor neuron action potential
- motor nuclei
- motor output
- motor protein** Proteins that create movement
- motor signal
- motor system. *See also* somatic motor division
- motor system output

Glossary/Index

- motor unit** Group of skeletal muscle fibers and the somatic motor neuron that controls them
- mouth
- movement
- execution
- feedback of information during
 - hand and eye
 - initiation
 - muscle
 - neural control of
 - planning
 - planning and coordinating complex
 - rhythmic
 - types of
 - voluntary
 - movement coordination
- movement of load
- mRNA. *See* messenger RNA
- mRNA processing
- mRNA translation
- MSH. *See* melanocyte-stimulating hormone
- mucin** Glycoproteins of mucus
- mucociliary escalator** The layer of mucus lining the respiratory tract that is moved upward by cilia so that it can be swallowed
- mucopolysaccharide
- mucopolysaccharide deposit
- mucosa** The inner lining of the intestinal tract
- mucosal membrane. *See also* apical membrane/surface
- mucous cell** Cell that secretes mucus. Synonym: goblet cell
See also goblet cell
- mucous layer
- mucous membrane
- mucous neck cell
- mucous secretion. *See also* mucus
- mucus** A thick, sticky exocrine secretion containing glycoproteins and proteoglycans
- mucus (goblet cell)
- mucus-bicarbonate barrier
- mucus droplet
- mucus layer
- mucus-secreting cells
- mucus secretion
- Müllerian duct** Embryonic structures that develop into female reproductive structures
- Müllerian inhibiting substance
- multinucleate cell
- multiple sclerosis
- multiple system atrophy
- multiple systems
- multipolar
- multipolar CNS interneurons
- multipotent** Undifferentiated cells in a tissue that can divide and develop into the specialized cells of that tissue
- multi-unit smooth muscle** Smooth muscle in which cells are not linked electrically and each muscle fiber is controlled individually
- multi-unit smooth muscle cell
- murmurs, heart
- muscarine** An agonist for cholinergic muscarinic receptors
- muscarinic
- muscarinic cholinergic
- muscarinic cholinergic receptor
- muscarinic receptor** One subtype of cholinergic receptor
- muscle** A collection of muscle cells. *See also specific muscle; specific type*
- antagonistic
 - biceps
 - body movement, mechanics of
- cardiac. *See also* heart
- cell
- contracted
 - contraction
 - disorders
 - elastic elements in
 - exercising
 - of expiration
 - extrafusal fibers
 - extraocular
 - fascicles
 - fast-twitch
 - fast-twitch glycolytic muscle
 - fast-twitch oxidative glycolytic
 - fatigue
 - fibers
 - fiber types
 - hamstring
 - high-intensity exercise
 - of inspiration
 - intrafusal fibers
 - length
 - length and tension
 - at low-intensity exercise
 - membrane potential (mV)
 - memory
 - metabolism
 - movement
 - origin
 - phasic smooth
 - quadriceps
 - red
 - reflexes
 - relaxed
 - at rest
 - resting
 - skeletal
 - slow-twitch
 - slow-twitch oxidative
 - smooth
 - spindle
 - spindles
 - stretch
 - striated
 - tension
 - terminology
 - of the thorax
 - tissues
 - tone
 - tonic smooth
 - triceps
 - twitch
 - types, comparison of the three
 - types of
 - ultrastructure of
 - vascular smooth
 - ventricular
 - visceral
 - white
- muscle action potential
- muscle blood flow
- muscle blood flow and exercise
- muscle cell. *See also* muscle fiber
- muscle contraction** Process by which a muscle creates force.
See also exercise
- muscle cramp
- muscle disease
- muscle fiber** A muscle cell
- muscle fiber action potential
- muscle fiber anatomy
- muscle glycogen
- muscle memory
- muscle metabolism
- muscle relaxation
- muscles of ventilation
- muscle spindle** Muscle receptors that send information about muscle length
- muscle spindle reflex
- muscle spindle sensory afferent neuron
- muscle tension
- muscle tissue
- muscle tone** The basal state of muscle contraction or tension that results from tonic activity of the muscle spindles
- muscular dystrophy
- muscularis externa
- muscularis mucosae
- musculoskeletal system
- mucus layer
- mutant channel
- mutant mouse model
- myasthenia gravis
- myelin** Concentric layers of cell membrane that wrap around and insulate axons
- myelinated axon
- myelinated fiber
- myelinated mammalian axon
- myelin-forming glia
- myelin membrane
- myelin of CNS neurons
- myelin of peripheral nerves
- myelin sheath
- myenteric plexus** Nerve network of the enteric nervous system that lies between the muscle layers
- myocardial
- myocardial action potential
- myocardial autorhythmic cell
- myocardial cell
- myocardial contractile cell
- myocardial infarction** A region of damaged myocardium caused by lack of blood flow myocardial muscle cell
- myocardium** Cardiac muscle *See also* cardiac muscle
- myoepithelial cell
- myoepithelium
- myofibril** Bundles of contractile and elastic proteins responsible for muscle contraction
- myogenic autoregulation
- myogenic contraction** Contraction that originates within the muscle fiber as a result of stretch
- myogenic response
- myoglobin** Oxygen-binding pigment in muscle that transfers oxygen between cell membrane and mitochondria
- myometrium** Smooth muscle layer of the uterus
- myophosphorylase deficiency
- myopia** Near-sightedness
- myosin** Forms thick filaments of the myofibril that convert chemical bond energy of ATP into motion
- myosin ATPase
- myosin ATPase activity
- myosin-binding site
- myosin binding site
- myosin crossbridge. *See* crossbridge
- myosin filament
- myosin head

Glossary/Index

- myosin light chain
- myosin light chain kinase (MLCK)** Enzyme that phosphorylates light protein chains of myosin in smooth muscle
- myosin light chain phosphatase (MLCP)
- myosin molecule
- myosin light chain phosphatase** Enzyme that dephosphorylates light protein chains of myosin in smooth muscle
- myotatic unit** Collection of synergistic and antagonistic muscles that act in a coordinated fashion to control a single joint
- myxedema
- N
- Na⁺, sodium ion
- Na⁺-Ca²⁺ exchanger (NCX)
- Na⁺-dicarboxylate cotransporter (NaDC)
- Na⁺-glucose secondary active transporter (SGLT)
- Na⁺-glucose symporter
- Na⁺-I⁻ symporter
- Na⁺-K⁺-ATPase. *See* sodium-potassium ATPase
- Na⁺ leak channel
- Na⁺-NH₄⁺ antiport
- Na⁺ reabsorption
- nAChR. *See* nicotinic receptor
- NaCl. *See* sodium chloride
- NAD (nicotinamide adenine dinucleotide)
- NADH
- Nagle, Matt
- NaHCO₃
- naïve cell
- naive lymphocyte** A lymphocyte that has not yet been exposed to its specific antigen
- nano- (n) (prefix)
- nasal cavity
- nasolacrimal duct
- nasopharynx
- National Science Foundation (NSF)
- natriuresis** Sodium (Na⁺) loss in the urine
- natriuretic peptide
- natriuretic peptide secretion
- natural killer cell (NK cell)** A type of lymphocyte that apparently attacks certain tumor and virus-infected cells
- natural painkillers
- natural protein
- nature of the signal
- NCAM. *See* nerve-cell adhesion molecule
- NCX antiporter
- near point of accommodation
- near-sightedness
- nebulin** Inelastic giant protein that aligns filaments of the sarcomere
- neck
- necrosis** Cell death due to toxins, physical damage, or lack of oxygen. The dying cell releases enzymes that may damage neighboring cells
- negative feedback** A homeostatic feedback loop designed to keep the system at or near a setpoint
- negative feedback loop
- negative feedback signal
- nephrin
- nephron** Microscopic tubule that is the functional unit of the kidney
- excretion
- filtration
- fluid volume modification
- function
- functional unit of the kidney
- osmolarity changes through the reabsorption
- secretion
- structure of the
- nephron cell
- Nernst equation** The equation that determines the equilibrium potential for a single ion based on the ion concentrations inside and outside the cell
- nerve** A collection of axons running between the central nervous system and the peripheral target cells
- nerve-cell adhesion molecule (NCAM)** Membrane proteins in nerve cells that aid cell growth
- nerve cell body
- nerve cell growth
- nerve cord
- nerve ending
- nerve fiber** Synonym: axon. *See also* axon
- nerve impulse
- nerve net
- nerves
- nerve tissue
- nervous reflex. *See* neural reflex
- nervous system** Network of billions or trillions of nerve cells linked together in a highly organized manner to form the rapid control system of the body. *See also* central nervous system (CNS); neuroendocrine reflex
- cell-cell communication
- cells of the
- development
- efferent divisions of the
- electrical signals in neurons
- evolution of
- flatworm
- human
- neural information transfer, integration of
- neural reflex pathways classification
- organization of the
- reflex control
- nervous system integrating center
- net absorption
- net driving pressure
- net glucose synthesis
- net glycogen synthesis
- net movement
- net pressure
- net reabsorption
- net synthesis
- network properties
- neural
- neural activity
- neural cell
- neural control of contraction
- neural control of movement
- neural control pathway
- neural crest cells** Embryonic cells that form the peripheral nervous system
- neural network
- neural pathway
- neural plate
- neural plate cell
- neural receptor
- neural reflex
- neural reflex pathway
- neural stem cell
- neural tissue
- neural tube** Embryonic cells that develop into the CNS
- neurocrine** Any molecule secreted by a nerve cell
- neurocrine molecule
- neurocrine receptor
- neuroeffector junction** Synapse between an autonomic neuron and its target muscle or gland
- neuroendocrine
- neuroendocrine control** Signal molecule secreted by a neuron into the blood, where it functions as a hormone
- neuro-endocrine-immune interaction
- neuroendocrine reflex
- neuroepithelium
- neurofilament** Intermediate filament of neurons
- neuroglia. *See also* glial cell
- neurohormone** A hormone that is produced and secreted by a neuron
- neurohypophysis. *See also* posterior pituitary
- neuroimmunomodulation** The ability of the nervous system to influence immune function
- neuromodulator** Chemicals that alter the response of a neuron more slowly than neurotransmitters
- neuromuscular junction** The synapse of a somatic motor neuron and a skeletal muscle fiber
- neuron A nerve cell, capable of generating and transmitting electrical signals. *See also* neuron; *specific type*
- autonomic pathways
- cellular and network properties
- communicate at synapses
- digestive system
- diffuse modulatory systems
- electrical signals, carry
- electrical signals in
- of enteric nervous system
- excitability of
- glial cells support for
- heart, as pump
- hormones
- hypokalemia
- hypothalamic–anterior pituitary pathway
- ion permeability of the
- larger, conduct action potentials faster
- in the medulla
- myenteric plexus
- in a network, tracing
- neural pathways may involve many
- parts of
- pituitary gland
- reflex pathway
- secrete chemical signals
- simple receptors
- for smell and vision
- stem cell repair of damaged
- submucosal plexus
- vasoconstrictor
- neuron anatomy
- neuron-target synapse
- neuropathic pain
- neuropeptide
- neuropeptide Y** Brain neurotransmitter that stimulates food intake
- neurotoxin** Chemical that adversely alters neuronal function
- neurotransmitter** A chemical signal released by a neuron that influences the neuron's target cell
- bipolar neurons
- calcium balance
- CCK as a
- diffuses away
- efferent division
- exocytosis of
- neurons (cellular and network properties)
- special senses receptors
- vasoconstrictor

Glossary/Index

- neurotransmitter (chemical signal)
 neurotransmitter molecules
 neurotransmitter receptors
 neurotransmitter release
 neurotransmitters and neuromodulators
 neurotransmitter synthesis
 neurotransmitter termination
neurotrophic factor Chemicals secreted by Schwann cells that keep damaged neurons alive
neutron Subatomic particle with no charge and mass of 1 amu
neutropenia Low number of neutrophils
neutrophils White blood cells that ingest pathogens and release cytokines
 neutrophil maturation
 newborn respiratory distress syndrome (NRDS)
 neutrophils
 NH₃
 NH₄⁺
 NHE antiporter (sodium-hydrogen exchanger)
 Nicolson, G. L.
nicotinamide adenine dinucleotide (NAD) Molecule that captures and transfers energy with high-energy electrons
nicotine An agonist of cholinergic nicotinic receptors and a chemical found in tobacco
 nicotinic
 nicotinic cholinergic receptors (AChR)
nicotinic receptor A type of acetylcholine receptor that also responds to nicotine
 NIDDM. *See* type 2 diabetes mellitus
 Niedergerke, Rolf
 nipple
 NIS. *See* sodium-iodide symporter
nitric oxide (NO) A short-acting paracrine that relaxes smooth muscle; also acts as a neurotransmitter and neuromodulator
nitric oxide synthase (NOS) Enzyme that synthesizes NO from arginine and oxygen
 nitrogen
 nitrogenous base
 nitrogenous waste
 NKCC symporter
 NK cell. *See* natural killer cell
NMDA receptor Glutamate receptor that opens only when the cell is depolarized
 NO. *See* nitric oxide
 Nobel, Alfred
nocebo effect Adverse effect that occurs because the patient expects it to
 nociception
 nociceptive pain
nociceptor A sensory receptor associated with pain
nocturnal enuresis Involuntary urination, especially bed-wetting at night
 node
nodes of Ranvier Unmyelinated regions on myelinated axons
 nodule
 nonadrenergic
nonadrenergic, noncholinergic neuron A neuron that secretes a neurotransmitter other than ACh
 nonassociative learning
 noncovalent bonds
 noncovalent interactions
 nonendocrine target
nongenomic effect of steroid hormones Actions of steroid hormones that do not require altered gene activity
 non-HDL cholesterol value
nonmembranous organelle Cell organelle that is not surrounded by a phospholipid membrane
 non-motile
 nonpainful stimuli
nonpenetrating solute A solute that cannot cross the cell membrane
nonpolar molecule A molecule whose electrons are distributed so evenly that there are no regions of partial positive or negative charge
 non-REM sleep
nonshivering thermogenesis Metabolic production of heat specifically for temperature regulation
 nonspecific immune response
 nonspecific response
 nonsteroidal anti-inflammatory drugs (NSAIDs)
 noradrenergic
 noradrenergic neurons
norepinephrine (NE) Primary neurotransmitter of the sympathetic division of the nervous system
 efferent division
 heart, as pump
 hormones
 neurons (cellular and network properties)
 vasoconstrictor
 normal blood value
 normal growth
 normal plasma glucose
 normal value
 normal ventilation value
 normokalemia
 NOS. *See* nitric oxide synthase
 nose. *See also* olfaction
 novel signal molecule
 noxious stimuli
 NP. *See* natriuretic peptide
 NPC1L1 cholesterol transporter
 NPR receptors
 NSAID. *See* nonsteroidal anti-inflammatory drug
 nuclear
 nuclear envelope
nuclear pores/nuclear pore complexes Protein complexes in the nuclear envelope with a central pore
 nuclear receptor
 nuclear receptor activator
 nucleic acid
 nucleolus
 nucleotide
 nucleotide polymer
nucleus (cell) Central body of a cell that contains DNA
 of columnar epithelial cell
 compartmentation
 of endothelial cell
 muscle
 sperm
 nucleus tractus solitarius (NTS)
 number
 nutrient
 placenta
 nutrient artery
 nutrient pool
 Nutrition Facts
 O
 O₂
 aerobic metabolism consumes
 aveoli, reaching
 cellular respiration, used in
 plasma, used in
 obese (*ob*) gene
obesity Excess body fat
 object
 object distance
 object image
 oblique muscle
 obstructive pulmonary disease (COPD)
 obstructive sleep apnea
 occipital bone
 occipital lobe
 occluded vessel
occluding junction A cell-cell junction that prevents movement of material between cells
occludin proteins Proteins in tight junctions
 occlusion
 ocular
 oculomotor
 oocyte
 odorant
 odorant molecule
 odorant receptor
 Ohm's Law
 oils. *See* lipid
 oleic acid
olfaction Pertaining to the sense of smell
 olfactory
olfactory bulb Part of the brain that receives input from primary olfactory neurons
 olfactory cilia
 olfactory cortex
 olfactory epithelium
 olfactory information
 olfactory nerve (cranial nerve I)
 olfactory neuron
 olfactory neuron axons (cranial nerve I)
 olfactory pathways
 olfactory sensory neuron
 olfactory system
 olfactory tract
oligodendrocyte CNS glial cell that forms myelin around several axons
 -ome (suffix)
 -omics (suffix)
 oncotic pressure. *See also* colloid osmotic pressure
 one-way flow
oocyte Developing female germ cells that have begun meiosis
 oocyte nucleus
oögonia Germ cells of the ovary
 Oparin, Aleksander
 open channel
 open system
 opioid peptide
 opioid receptor
opsin Visual pigment forms from rhodopsin when light strikes it; opsin initiates a signal transduction cascade
opsonins Proteins that coat pathogens to make them targets for immune cells
optic chiasm Portion of the brain where some fibers from each eye cross to opposite sides of the brain
optic disk Region of the retina where the optic nerve and blood vessels exit the eye
 optic nerve
optics The physical relationship between light and lenses
optic tract Neurons leading from the eyes to the visual cortex
 oral (or intravenous) intake of water
 oral cavity
 oral contraceptive
 oral glucose tolerance test
orbit Bony cavity that protects the eye
 orexin

Glossary/Index

organ Group of tissues that carries out related functions

organelle Assorted intracellular structures that each take on one or more of the cell's functions. *See also specific type*

organic acid

organic anions (OA⁻)

organic anion secretion

organic anion transporter (OAT)

organic metabolite

organic molecules Molecules that contain carbon

organism

organisms, living

organ of Corti Portion of the cochlea that contains the hair cells

organ system

orgasm A series of involuntary muscular contractions during the sex act, accompanied by sensations of intense pleasure

origin of a muscle The end of the muscle attached closest to the trunk or to the more stationary bone

oropharynx receptor An unidentified receptor that monitors oral water intake

orphan receptor One that has no known ligand

orthostatic hypotension Low blood pressure that occurs when going from the supine position to standing up

oscillation

osmolality Concentration expressed as osmoles solute per kilogram of water

osmolality Concentration expressed in osmoles per liter

blood volume and disturbances in increased

integrated control of nephron, changes through the responses triggered by changes in salt ingestion

transport processes and tonicity

vasopressin release

osmole

osmometer An instrument for measuring osmolality of a fluid

osmoreceptor Sensory receptor that monitors extra-cellular fluid osmolality

osmosis The movement of water across a membrane in response to a solute concentration gradient

osmotic diarrhea

osmotic diuresis Water loss in the urine due to unreabsorbed solute in the tubule lumen

osmotic equilibrium

osmotic pressure The pressure that exactly opposes a given concentration gradient

osteoblast Cells that produce bone

osteocalcin

osteoclast Large, mobile, multinucleate cell that is responsible for bone resorption

osteocyte A less active form of osteoblast

osteoid

osteopenia

osteoprotegerin (OPG)

otolith Small calcium carbonate crystals whose movement activates hair cells for equilibrium

otolith membrane Gelatinous mass within which otoliths are embedded

otolith organ The utricle and saccule of the vestibular apparatus that sense linear acceleration and head position

ouabain Cardiac glycoside that specifically inhibits the Na⁺-K⁺-ATPase

outgoing signal

output

output (efferent) signal

output (metabolic removal)

output pathway

output signal

ova. *See also ovum*

oval window Membrane between the middle ear and cochlea

ovarian cycle The monthly cycle of egg development in the ovary

ovarian hormone level

ovarian phase

ovary The female gonad

overactive response

overshoot

oviduct. *See also Fallopian tube*

ovulation Release of a mature egg from its follicle in the ovary

ovum The female gamete. Synonym: egg

oxidation

oxidation-reduction reaction Involves the transfer of electrons or protons (H⁺) between chemicals

oxidative

oxidative phosphorylation Mitochondrial pathway that consumes oxygen and high-energy electrons and produces ATP and water

oxidative stress

oxidized molecule Molecules that lose electrons or gain H⁺ in a chemical reaction

oxygen

alveolar-capillary interface, enters blood at alveoli and blood, diffusion between cells, diffuses into consumption and exercise intensity

dissolved in plasma (Po₂ of plasma)

Hb binding sites

hemoglobin, is transported in blood dissolved in plasma or bound to hemoglobin binds to hemoglobin transport to the tissues

placenta

plasma, dissolves in and red blood cells

solubility

transport

ventilation, influence on

oxygenated blood

oxygen binding

oxygen consumption The disappearance of oxygen during oxidative phosphorylation, when oxygen combines with hydrogen

oxygen deficit Oxygen needed for metabolism to replace muscle ATP and phosphocreatine reserves

oxygen-Hb binding

oxygen binding

oxygen transport

oxygen uptake

oxyhemoglobin (HbO₂) Hemoglobin bound to oxygen *See also oxyhemoglobin saturation curve*

oxytocin Posterior pituitary hormone that causes uterine and breast smooth muscle contraction

oxytocin neuron

P

P. *See pressure gradient*

P_A. *See alveolar pressure*

pacemaker of the heart The fastest depolarizing cell, usually in the SA node

pacemaker neuron

pacemaker potential Cyclic depolarizations of smooth and cardiac muscle that always reach threshold

Pacinian corpuscle Sensory receptors of skin that sense vibration

PAF. *See platelet-activating factor*

Paget's disease

pain The brain's perception of irritating or damaging stimuli

pain modulation

pain pathway

pain receptor. *See also nociceptor*

pain signal

pancreas Digestive organ that secretes enzymes, bicarbonate, and hormones

beta cells of digestive system hormones

pancreatic acini

pancreatic beta cell antigen

pancreatic bicarbonate secretion

pancreatic disease

pancreatic duct

pancreatic duct cell

pancreatic endocrine cell

pancreatic enzyme secretion

pancreatic islet cell

pancreatic polypeptide

pancreatic secretion

pancreatic zymogen

panting

Papanicolaou, George

papillary muscle Small muscle in the interior of the ventricles to which the chordae tendineae attach

pap smear

pap test

para- (prefix)

paracellular absorption

paracellular movement

paracellular pathway

paracellular transport

paracrine

paracrine feedback

paracrine release

paracrine secretion

paracrine signal A chemical secreted by a cell that acts on cells in the immediate vicinity

paracrine signaling

parallel light ray

parallel processing One function is carried out by more than one region of the CNS

paralysis

Paramecium

parameter One of the variables in a system

parasite

parasitic infection

parasympathetic activity

parasympathetic branch Division of the autonomic nervous system that is responsible for day-to-day activities

parasympathetic control

parasympathetic division

Glossary/Index

- parasympathetic innervation
 parasympathetic nerve
 parasympathetic nervous system
 parasympathetic neuron
 parasympathetic output
 parasympathetic pathway
 parasympathetic response
 parasympathetic stimulated
 parathormone. *See also* parathyroid hormone
 parathyroid gland
parathyroid hormone (parathormone, or PTH) Hormone from the parathyroid glands that increases plasma Ca^{2+} concentration
 paraventricular
 paravertebral
 parietal bone
parietal cells Cells of the stomach that secrete hydrochloric acid
 parietal lobe
 parietal pleura
 Parkinson's disease
 parotid
 parotid salivary gland secretion
partial pressure The pressure of a single gas
 partial pressure (P_{gas})
 partition
parturition The birth process
 parvocellular ganglion cell (P cell)
 passive
 passive filtration
 passive immunity
 passive process
 passive reabsorption
passive transport Movement across a membrane that does not depend on an outside source of energy

 patellar tendon (knee jerk) reflex
 pathological hyponatremia
pathogen Any substance capable of causing disease
 pathogen-associated molecular patterns (PAMPs)
 pathogen cell
 pathological dehydration
 pathological hyponatremia
 pathological pain
 pathologies
 pathophysiology
pathways Network of interconnected chemical reactions formed by the enzymatic reactions of metabolism
 collateral
 pupillary reflexes
 vision
 pattern recognition receptor (PRR)
 patterns of reproduction
 Pavlov
 P_{cap}. *See also* capillary hydrostatic pressure
P cell (1) Parvocellular ganglion cells of the retina that transmit information about color, form, and texture

 P_{co₂}
 hemoglobin's affinity for oxygen, effect of
 PCOS. *See* polycystic ovary syndrome
 PDE-5. *See* phosphodiesterase-5
 PDGF. *See* platelet-derived growth factor
 pectoral fat pad
 pectoralis major muscle
 pelvic cavity
 pelvic lymph node
 pelvic nerve
 pelvis

 pendrin (SLC26A4)
 pendrin transporter
penetrating solute A solute that freely crosses the cell membrane
 Penfield, W.
 penicillin
 penicillin clearance
 penicillin molecules
 penicillin secretion
Penicillium
 penile arterioles vasodilate
 penis
 pentose
pepsinogen The inactive form of pepsin
 pepsin release
 pepsin secretion
 PepT1
 peptic ulcer
peptidase Enzyme that breaks up peptides into smaller peptides or amino acids
peptide A chain of 2-9 nine amino acids
 absorption
 by active transport
 fragment
peptide bond Bond formed between carboxyl group of one amino acid and amino group of another amino acid
peptide hormone Any hormone made of amino acids, including peptides, proteins, and glycoproteins
 cellular mechanism of action of
 membrane receptors and signal transduction for
 synthesis, storage, and release
 synthesis and processing
 transport in the blood and half-life of
 percent saturation of hemoglobin
percent solution Solution concentration expressed as parts of solute per 100 parts of total solution
 perception
perceptual threshold The level of stimulus intensity necessary for awareness
perforin Pore-forming protein secreted by immune cells

perfusion Blood flow to lung tissues. *See also* blood flow
 pericardial cavity
pericardial membrane The connective tissue membrane of the pericardium
 pericardial sac
pericarditis Inflammation of the pericardial sac
pericardium A tough membranous sac that encloses the heart
pericytes Cells that form a meshlike outer layer between the capillary endothelium and the interstitial fluid

perilymph Fluid within the vestibular and tympanic ducts of the cochlea
 periodic breathing
 periodic paralysis
 periodic table of the elements, inside cover
 peripheral blood flow
 peripheral blood pressure
peripheral chemoreceptor Chemoreceptors not found in the CNS
 peripheral component
 peripheral fatigue
 peripheral ganglia
 peripheral nerve
peripheral nervous system (PNS) All neurons that lie completely or partially outside the central nervous system

 efferent division of the
 sensory division of the
 peripheral neuron injury
peripheral protein Proteins attached to membrane-spanning proteins or to the polar regions of membrane phospholipids.
peripheral receptor Sensory receptors that are not located in or close to the brain
peripheral resistance Resistance to blood flow created primarily by the arterioles
 peripheral sensory receptor
 peripheral thermoreceptor
 peripheral tissue
peristalsis Waves of contraction that move along the gastrointestinal tract
 peristaltic contraction
 peristaltic mixing
 peristaltic propulsion
peritoneal membrane Lines the inside of abdominal cavity
peritoneum A membrane that lines the abdomen
 peritubular capillaries
 peritubular capillary pressure
 permeability to ion
 permeable
 permissive effect
 permissive hormone
permissiveness One hormone cannot exert its effects fully unless a second hormone is present
 pernicious anemia
peroxisome Storage vesicles that contain enzymes to degrade long-chain fatty acids and potentially toxic foreign molecules
 peroxisome proliferator-activated receptors (PPARs)
 personality
 PET scan
Peyer's patch Bump of lymphoid tissue visible in the mucosa of the GI tract
 P_{fluid}. *See* fluid pressure
 P_{gas}. *See* partial pressure
 PGI₂. *See* prostaglandin I
 P_{H₂O}. *See* hydrostatic pressure
pH A measure of the concentration of H⁺; $\text{pH} = -\log [\text{H}^+]$
 in acid-base disturbances
 balance in the body
 central and peripheral chemoreceptors monitor blood gases and
 denature proteins, changes can
 disturbances
 hemoglobin's affinity for oxygen, effect of
 homeostasis. *See also* acid-base balance
 renal and respiratory compensation
 of the stomach
 ventilation, influence on
phagocyte Immune cell that ingests material by phagocytosis
 phagocyte lysosome
 phagocyte receptor
phagocytosis The process by which a cell engulfs a particle into a vesicle by using the cytoskeleton to push the membrane around the particle
phagosome The vesicle formed around ingested material during phagocytosis; site of digestion
 phantom limb pain
 pharmacogenomics
 pharmacological doses
pharmacomechanical coupling Contraction that occurs in smooth muscle as a result of a ligand binding; not accompanied by a change in membrane potential

Glossary/Index

- pharynx
- phase numbers
- phasic contraction
- phasic receptor** Rapidly adapting receptors that are attuned to changing conditions
- phasic smooth muscle
- pheromone** External hormones secreted to influence others of the same species.
- phlegm
- phosphatase
- phosphatase activity
- phosphate
- phosphate buffer
- phosphate group. *See also* acid-base balance
- phosphate homeostasis
- phosphate ion
- phosphate-mediated Ca^{2+} sensitivity
- phosphates, in cell
- phosphocreatine** Muscle molecule that stores energy in high-energy phosphate bonds
- phosphodiesterase-5 (PDE-5)
- phospholamban** Regulatory protein in contractile myocardium that alters Ca^{2+} -ATPase activity in the sarcoplasmic reticulum
- phospholipase
- phospholipase A2 (PLA2)** Enzyme that converts membrane phospholipids to arachidonic acid
- phospholipase C** Enzyme that converts a membrane phospholipid into two different second messenger molecules, DAG and IP_3
- phospholipid** Diglycerides with phosphate attached to the single carbon that lacks a fatty acid
- phospholipid bilayers
- phospholipid molecule
- phospholipids
- phosphorylase
- phosphorylate
- phosphorylated protein
- phosphorylation** Addition of a phosphate group to a molecule
- photopigment synthesis
- photoreceptors** Sensory receptors in the eye that respond primarily to light energy
- phototransduction** Conversion of light energy to action potentials
- phrenic nerve
- physical activity. *See also* exercise
- physical barrier
- physical factor
- physical requirements
- physical stress
- physiological behavior
- physiological function
- physiological psychology
- physiological response
- physiology** The study of the normal functioning of a living organism and its component parts
- control systems and homeostasis
- homeostasis
- as an integrative science
- levels of organization in
- physiologic systems and
- science of
- themes in
- Physiome Project
- phytoestrogens
- P_1
- pia mater** Inner membrane of the meninges
- pico- (p) (prefix)
- picolinate
- pigment epithelium
- pigment epithelium cell
- PIH. *See* prolactin-inhibiting hormone
- piloerection** Hair standing on end
- pineal gland
- pinna** The outer ear
- pinocytosis
- pitch** Physiological interpretation of sound wave frequency
- pituitary
- pituitary gland** Endocrine and neuroendocrine gland that lies beneath the hypothalamus
- pituitary gonadotropins (FSH and LH)
- pituitary tumor
- Pk, *see* protein kinase
- PK A. *See* protein kinase A
- PK C. *See* protein kinase C
- PLA2. *See* phospholipase A2
- placebo
- placebo effect
- placenta
- placental membrane
- planning
- planning movement
- plaque** Deposition of lipid in arterial walls, accompanied by smooth muscle proliferation, scar tissue formation, and calcification
- plasma** The fluid portion of the blood
- ANG I
- antibodies in
- concentration
- cortex is isosmotic to
- filtration fraction
- and insulin
- Oxygen dissolves in
- P_{CO_2}
- proteins
- transferrin protein transports Fe in
- plasma amino acids
- plasma Ca^{2+}
- plasma Ca^{2+} concentration
- plasma calcium
- plasma calcium regulation
- plasma cell** Type of lymphocyte that secretes antibodies
- plasma cholesterol
- plasma clotting factor
- plasma cortisol concentration
- plasma fatty acids
- plasma glucagon concentration
- plasma glucose
- plasma glucose concentration
- plasma glucose homeostasis
- plasma glucose level
- plasma H^+
- plasma hormone
- plasma insulin concentration
- plasma ion
- plasma membrane** The cell membrane that serves as both a gateway and a barrier for substances moving into and out of the cell. *Synonym:* cell membrane. *See also* cell membrane
- plasma osmolarity
- plasma pathway
- plasma Po_2
- plasma protein
- plasma protein carrier
- plasma protein concentration
- plasma volume
- plasmin** Enzyme that breaks down fibrin. *Synonym:* fibrinolysin
- plasminogen
- plasticity** Ability of adult stem cells to develop into multiple cell types
- plateau phase** (1) Flattening of the myocardial contractile cell action potential due to Ca^{2+} entry or (2) intermediate phase of the human sexual response
- platelet** Cell fragments that participate in coagulation. *Synonym:* thrombocyte
- platelet-activating factor (PAF)
- platelet activation
- platelet adhesion** Platelets stick to exposed collagen in wall of damaged blood vessel
- platelet aggregation** Activated platelets stick to each other
- platelet-derived growth factor (PDGF)
- platelet factor
- platelet function
- platelet lipid
- platelet membrane
- platelet mitochondria
- platelet plug
- platelet plug formation
- platelet production
- platelet-rich plasma (PRP) therapy
- PLC. *See* phospholipase C
- pleated sheet
- pleura** The membranes that line the chest cavity and cover the outer surface of the lungs
- pleural cavity
- pleural fluid
- pleural membrane
- pleural sac
- plicae** Large folds of the intestinal wall
- pluripotent cell** A stem cell that can develop into many but not all cell types
- pluripotent hematopoietic stem cell
- pneumonia** Bacterial or viral lung infection
- pneumothorax** Air in the intrapleural space
- PNS. *See* peripheral nervous system
- Po_2
- podocin
- podocyte** Specialized epithelial cells in Bowman's capsule that surround each capillary and form filtration slits
- podocyte foot
- Poiseuille's law
- polar body, first and second** Unused chromosomes that are discarded from the egg as it undergoes meiosis
- polarity, of cell** Cells restrict certain membrane proteins to particular regions, thereby creating cells with different functions in different areas
- polar molecule** Molecules that develop regions of partial positive and negative charge when one or more atoms in the molecule have a strong attraction for electrons
- polar side chain
- polio
- polycystic ovary syndrome (PCOS)
- polycythemia** Elevated hematocrit
- polydipsia** Excessive drinking
- polymer
- polymeric protein
- polymorphonuclear leukocyte. *See also* neutrophil
- polypeptide** A chain of 10–100 amino acids

Glossary/Index

- polyphagia** Excessive eating
- polyploid cell** A cell with multiple nuclei and therefore greater than the diploid amount of DNA
- polysaccharides** Complex carbohydrates composed of glucose polymers; used for energy storage and structure
- polysaccharide capsule
- polyspermy** Fertilization of an egg by more than one sperm
- polysynaptic reflex** Any nervous reflex that has three or more neurons in the pathway
- polyunsaturated fatty acid** A fatty acid with more than one double bond
- polyuria** Excessive urination
- POMC. *See* pro-opiomelanocortin
- pons** Region of the brain stem that contains centers for respiration and serves as a relay station
- pontine nuclei
- pontine respiratory group (PRG)
- population coding** The number of sensory receptors activated encodes the intensity of a stimulus
- pores. *See also* leak channel
- porphyrin
- porphyrin ring
- portal system** A specialized region of the circulation consisting of two capillary beds directly connected by a set of blood vessels
- portal vessel
- positional vertigo
- positive charge flow
- positive electrical charge
- positive emission tomography (PET)
- positive feedback loop** A feedback loop in which the response reinforces the stimulus, triggering a vicious cycle of ever-increasing response
- positive feedback mechanism
- positive inotropic agent
- positive pressure gradient (δP)
- positive-pressure ventilation
- positive reinforcer
- positron emission tomography (PET)
- postabsorptive state** A catabolic state, in which the body taps into its stored reserves and the cells degrade large molecules into smaller molecules. Synonym: fasted state
- posterior canal
- posterior pituitary gland** An extension of the brain that secretes neurosecretory hormones made in the hypothalamus
- posterior pituitary store
- postexercise oxygen consumption
- postganglionic autonomic neuron
- postganglionic autonomic neurotransmitter
- postganglionic neuron** Autonomic neuron that has its cell body in the ganglion and sends its axon to the target tissue
- postganglionic parasympathetic
- postganglionic sympathetic neuron
- post-luteal phase
- postsynaptic cell** The target cell at a synapse
- postsynaptic dendrite
- postsynaptic inhibition
- postsynaptic integration** Multiple signals in a postsynaptic cell combine to create a single integrated signal
- postsynaptic membrane
- postsynaptic modulation** A modulatory neuron, usually inhibitory, synapses on the dendrites or cell body of a post synaptic cell
- postsynaptic neuron
- postsynaptic response
- post-translational modification** Alterations to a protein molecule made after translation
- post-translational modification of prohormones
- post-translational processing of pOMC
- postural adjustment
- postural disturbance
- postural reflexes** Reflexes that help us maintain body position
- posture
- potassium. *See also* potassium ion
- potassium (K^+)
- potassium and cell excitability
- potassium balance. *See also* hyperkalemia; hypokalemia
- potassium ion
- potassium ion channel
- potassium ion concentration
- potassium ion efflux
- potassium ion leak channel
- potassium ion secretion
- potential
- potential difference
- potential energy** Stored energy that has the ability to do work
- potentiator
- power stroke** Movement of the myosin head that is the basis for muscle contraction
- PPAR α
- PPAR γ
- PP cell** Pancreatic endocrine cell that secretes pancreatic polypeptide
- P-Q segment
- Pre-Bötzing complex
- precapillary sphincter** Bands of smooth muscle that can alter blood flow through capillary beds
- precursor molecule
- pre-diabetes
- preeclampsia
- preexisting antibodies
- prefrontal association area
- prefrontal cortex
- preganglionic autonomic neuron
- preganglionic axon
- preganglionic neuron** Autonomic neuron that originates in the central nervous system and terminates in an autonomic ganglion
- preganglionic parasympathetic neuron
- preganglionic sympathetic neuron
- pregnancy
- pregnancy and parturition
- pregnancy prevention
- preload** The degree of myocardial stretch created by venous return
- premature ventricular contractions (PVCs)
- premotor cortex
- prohormone** Inactive molecule composed of one or more copies of a peptide hormone, a signal sequence, and other peptide sequences that may or may not have biological activity
- prepuce (foreskin)
- presbycusis** Age-related hearing loss
- presbyopia** Loss of the accommodation reflex with aging
- pressure
- Law of LaPlace
- pressure (mm Hg)
- pressure gauge
- pressure gradient (δP)
- pressure reservoir
- pressure-volume curve
- pressure-volume relationship
- pressure wave
- presynaptic axon terminal
- presynaptic cell** The cell releasing neurotransmitter into a chemical synapse
- presynaptic facilitation** Modulation of the presynaptic neuron that enhances neurotransmitter release
- presynaptic inhibition
- presynaptic membrane
- presynaptic neuron
- presynaptic neuron branches
- primary active transport** The energy for transport comes from the high-energy phosphate bond of ATP
- primary auditory neuron
- primary bronchi** The first two airways created by branching of the trachea
- primary cilia
- primary follicle** An undeveloped oocyte and its outer layer of granulosa cells
- primary hypercortisolism
- primary hypersecretion
- primary hypersecretion of cortisol
- primary hypothyroidism
- primary immune response** The immune response that occurs with first exposure to a pathogen
- primary immunodeficiency
- primary lymphoid tissue
- primary motor cortex** Regions of the frontal lobe that coordinate skeletal muscle movements
- primary neuron
- primary oocyte** Oocyte that has duplicated its DNA but not undergone a meiotic division
- primary pathology
- primary sensory neuron** The sensory neuron that takes information from the sensory receptor into the spinal cord
- primary sex characteristics** The internal sexual organs and external genitalia that distinguish each sex
- primary spermatocyte** Spermatocyte that has duplicated its DNA but not undergone a meiotic division
- primary structure, of protein** The sequence of amino acids in the peptide chain
- primitive brain
- principal cell
- procarboxypeptidase
- procedural memory
- processes of a neuron
- process maps
- procolipase
- procreation** The act of creating a new being
- production of hormones
- proenzyme** An inactive enzyme
- progenitor cell
- progesterone** Female sex hormone produced by the corpus luteum
- programmed cell death. *See also* apoptosis
- prohormone** Inactive protein containing one or more copies of a hormone

Glossary/Index

- proinsulin
- prokaryotic endosymbiont theory
- prolactin** A peptide hormone from the anterior pituitary that controls milk production in the breast
- prolactin (PRL)
- prolactin cell
- prolactin-inhibiting hormone (PIH)** Hypothalamic hormone that inhibits prolactin secretion by the anterior pituitary. *See also* dopamine
- prolapse
- proliferative phase** Phase of the menstrual cycle when the endometrium grows and thickens
- promoter** Section of DNA near the starting end of a gene that must be activated to begin transcription
- pro-opiomelanocortin (POMC)** Anterior pituitary pro-hormone that is processed into ACTH and other active fragments
- propeptide
- prophospholipase
- proprioception** Awareness of body position in space and of the relative location of body parts to each other
- proprioception pathway
- proprioceptor
- propriospinal tract** Tracts of white matter that remain within the cord
- propulsion by segmentation
- prospective study** Study recruits healthy subjects and watches for development of disease
- prostacyclin** Eicosanoid in membrane of intact endothelial cells that prevents platelets from adhering
- prostaglandin** Lipid-derived molecules that act as physiological regulators
- prostaglandin I
- prostanoid** Eicosanoid signal molecules that include prostaglandins and thromboxanes
- prostate
- Prostate Cancer Prevention Trial (PCPT)
- prostate gland** Male accessory organ that contributes enzymes, nutrients, and other secretions to semen
- prostate specific antigen (PSA)
- protease** Enzymes that break proteins up into smaller peptides
- proteasome** Cylindrical cytoplasmic enzyme complex that destroys proteins
- protective epithelium
- protective reflex
- protective response
- protein** A chain of more than one hundred amino acids. *See also* membrane protein; *specific type*
- absorption
 - accessory
 - activation
 - activity
 - alternative splicing
 - alternative splicing of DNA sequence
 - amino acids make
 - antibodies
 - binding
 - biochemistry of
 - β lymphocytes
 - breakdown
 - as buffer system
 - Ca²⁺ binds to
 - cell function
 - cell membrane components
 - in cells
 - concentration
 - cytokines
- digestion
- energy storage
- and enzymes
- fibrous
- globular
- inhibition
- integral
- membrane composition
- modification
- molecular interactions and
- motor
- natural
- opsonins
- peptides and amino acids
- peripheral
- post-translational modification
- receptor
- regulatory
- signal transduction
- sorting
- structure of
- transmembrane
- protein activity
- protein "alphabet"
- protein binding
- protein-binding reaction
- protein-bridge tip links
- protein C
- protein catabolism
- protein chain
- protein channel
- protein fiber
- protein folding
- protein globin chain
- protein hormone
- protein interaction
- protein kinase** Enzymes that transfer a phosphate group from ATP to a protein
- protein kinase A (PKA)
- protein kinase C (PKC)** Associated membrane enzyme that is activated by DAG and Ca²⁺
- protein-ligand (L) binding
- protein-mediated transport
- protein metabolism
- protein pumps
- protein sorting
- protein synthesis
- in osteoclasts
- proteinuria
- proteoglycans** Glycoproteins in extracellular matrix
- proteolytic
- proteolytic activation
- proteome** The protein equivalent of the genome; all proteins that can be synthesized from an organism's DNA
- proteomic
- prothrombin
- proton** Subatomic particle with one positive charge and mass of 1 amu
- proton pump inhibitors (PPIs)
- proximal axon
- proximal tubule** The initial segment of the kidney tubule where most reabsorption takes place
- PR segment** From the end of the P wave to the beginning of the QRS complex
- PSA. *See* prostate specific antigen
- pseudohermaphroditism
- pseudohypoparathyroidism
- pseudounipolar neuron
- psychological factors
- PTH. *See* parathyroid hormone
- puberty** The period in the early teen years when the gonads mature and produce gametes
- pubic symphysis (cartilage)
- puendum. *See also* vulva
- pulmonary
- gas exchange and transport
 - volume and capacity
- pulmonary artery** Blood vessel that carries low oxygen blood from the right heart to the lung
- pulmonary capillaries
- pulmonary circulation** That portion of the circulation that carries blood to and from the lungs
- pulmonary edema** Excessive interstitial fluid volume in the lungs
- pulmonary function tests
- pulmonary medicine
- pulmonary semilunar valve
- pulmonary system
- pulmonary trunk** The single artery that receives blood from the right ventricle; splits into left and right pulmonary arteries
- pulmonary valve** The semilunar valve between the right ventricle and the pulmonary trunk
- pulmonary vein** Vessel that carries well-oxygenated blood from the lung to the left heart
- pulmonary ventilation
- pulsatile blood flow
- pulsatile GnRH release
- pulse** Pressure wave that is transmitted through the fluid of the cardiovascular system
- pulse generator** Region of the hypothalamus that coordinates the pulsatile secretion of GnRH
- pulse oximeter
- pulse pressure** The strength of the pulse wave, defined as the systolic pressure minus the diastolic pressure
- pumony function
- pump handle motion
- pumps. *See also* ATPase
- pupil
- pupil constriction
- pupil dilation
- pupillary constriction
- pupillary muscle
- pupillary reflex** Constriction of the pupil in response to light
- purine
- purinergic receptor** A receptor that binds to purines, such as AMP or ATP
- Purkinje fiber** Specialized myocardial cell that rapidly conducts electrical signals to the apex of the heart
- purple petunias
- pus
- push-pull control
- P wave** Wave of the ECG that represents atrial depolarization
- pyloric sphincter. *See* pylorus
- pyloric valve
- pylorus** The region of increased muscle tone separating the stomach and small intestine
- pyramid** Region of the medulla where neurons from one side of the body cross to the other
- pyramidal cell
- pyramidal tract** Descending pathways for movement that pass through the pyramids

Glossary/Index

pyrimidine
pyrogen Fever-causing substances
 pyruvate

Q

QRS complex Wave complex that represents ventricular depolarization and atrial repolarization
QT interval From the beginning of the Q wave to the end of the T wave. Corresponds to ventricular contraction
 quadriceps
quaternary structure, of protein Arrangement of a protein with multiple peptide chains

quiescent
Q wave First wave of ventricular depolarization

R

rabs
 radial artery
 radiant heat gain
 radiant heat loss
radiation Energy emitted by unstable isotopes
 radio wave
 radius
 ramping
 raphe nuclei
 rapid cellular response
 rapid phase
 rapid repolarization
 Rasmussen, T.
 RAS pathway
 rate of diffusion
 rate of reaction

reabsorption Movement of filtered material from the lumen of the nephron to the blood

H₂O
 peritubular capillaries
 peritubular capillary pressures

reactant
 reaction
 reaction rate
 reaction reversibility
reactive hyperemia An increase in tissue blood flow following a period of low perfusion
 reactive oxygen species (ROS)

reading
 recall
 receiving segment
receptive aphasia Inability to understand spoken or visual information due to damage to Wernicke's area
receptive field The region within which a sensory neuron can sense a stimulus

receptive relaxation
receptor (1) A cellular protein that binds to a ligand; (2) A cell or group of cells that continually monitor changes in the internal or external environment
 chemoreception

 homeostatic reflex pathways
 hormone release
 sensory system
 signal pathways
 signal transduction
 types of

receptor activation
receptor adaptation A repeated stimulus loses its ability to stimulate a receptor

receptor cell
 receptor cells (type II)
 receptor-channel

receptor-enzyme Membrane proteins that bind ligands on the extracellular side and activate enzymes on the intracellular side

receptor-hormone complex
 receptor-ligand
receptor-mediated endocytosis A ligand binds to a membrane protein, which triggers endocytosis of the membrane-receptor complex

receptoroperated calcium channels (ROCC)
receptor potential Graded potential in a special senses receptor

receptor protein
 receptor region
reciprocal inhibition The relaxation of antagonistic muscles during a contraction reflex

reciprocal inhibition control movement
recruitment Addition of motor units to increase the force of contraction in a muscle
 rectal wall

rectifying synapse
rectum The distal segment of the large intestine

red blood cell (RBC)
 accelerated loss
 CO₂ diffusion disorders
 Hb content per with hemoglobin
 life span
 maturation
 membrane
 nucleus, lack a
 and oxygen
 oxygen-carrying capacity
 production
 synthesis

red cell count
 red cell volume
"red muscle" Muscle that has lots of mitochondria and good blood supply so that it can carry out oxidative metabolism

red pulp
 reduction
referred pain Pain that is felt in a location away from the actual site of the stimulus

reflex Any long-distance pathway that receives input about a change, integrates the information, and uses the nervous system, endocrine system, or both to react appropriately

contraction
 control
 control of ventilation
control pathway Long-distance homeostatic control in which the decision that a response is needed is made away from the cell or tissue
 control pathway feedback loop

development
 involving GI peptides and the lungs
 movement and muscle tone
 pathway
 protective response

reflexive memory Automatic memory that is acquired slowly through repetition and does not require conscious processes for its creation or recall. Synonym: implicit memory

refract
 refractory

refractory period
 refractory region
 regenerating conduction signal
 regulated activity
 regulated variables
 regulation
 regulation of GI function
 regulation of osmolarity
 regulation of ventilation
 regulatory protein
 reinforcement
 relative charge scale
 relative increase
 relative motion of basilar membrane (μm)
 relative polycythemia

relative refractory period A period of time immediately following an action potential during which a higher-than-normal graded potential is required to start another action potential

relaxation
 cardiac contractile cell
 relaxation (diastole)
 relaxation phase
 relaxed state
relaxin Peptide hormone secreted by the ovary and placenta to prepare the uterus and pelvis for delivery

relay nuclei
 relay station
 release signal
 releasing hormone
 REM (rapid eye movement) sleep
 renal (kidney) failure

renal arteries
 renal arterioles
 renal blood flow
 renal clearance
 renal collecting duct
 renal compensation
 renal compensation for acidosis
renal corpuscle The combination of glomerulus and Bowman's capsule

renal countercurrent multiplier
 renal handling
 renal mechanisms
 renal mechanisms for acid-base balance
renal medulla Inner portion of the kidney whose interstitial osmolarity ranges from 300–1200 mOsm

renal pelvis
 renal physiology. *See also* kidney function
 renal reabsorption of Ca²⁺
 renal sodium reabsorption
 renal system

renal threshold The plasma concentration at which saturation of the transporters occurs

renal transport
 renal transport and saturation
 renal vein

renal water reabsorption
renin Peptide secreted by juxtaglomerular cells that converts angiotensinogen into angiotensin I
 renin-angiotensin pathway

renin-angiotensin system (RAS) Endocrine pathway that plays an important role in blood pressure regulation and renal Na⁺ handling

renin secretion
 replacement therapy
 replication

repolarization Phase during which depolarized membrane returns to its resting potential

Glossary/Index

- repressed gene
- repression
- reproduction
- aging
- basic patterns of
 - brain directs
 - and development
 - environmental influences on
 - female
 - growth
 - hormonal control of
 - male
 - parturition
 - patterns of
 - pregnancy
 - procreation
 - puberty marks the beginning of
 - sex determination
- reproductive function
- reproductive system
- female
 - male reproduction
- reproductive years
- residual volume (RV)** The volume of air left in the lungs following a maximal exhalation
- resistance,
- resorption of bone** Process in which osteoclasts dissolve the calcium phosphate matrix
- respiration** (1) Cellular use of oxygen and substrates to produce energy; (2) Exchange of gases between the atmosphere and the cells. *See also* cellular respiration; external respiration
- respiration rate
- respiratory
- acid-base disturbances
 - respiratory acidosis** Acidosis due to retention of CO₂
 - respiratory alkalosis** Alkalosis due to hyperventilation that decreases arterial P_{CO₂}
 - respiratory bronchioles
 - respiratory center
 - respiratory compensation
 - respiratory control center
 - respiratory cycle** An inspiration followed by an expiration
 - respiratory distress syndrome, newborn. *See* newborn respiratory distress syndrome
 - respiratory exchange ration (RER)
 - respiratory muscle
 - respiratory pump
 - respiratory quotient (RQ)** The ratio of CO₂ produced to O₂ consumed during metabolism
 - respiratory rate
 - respiratory system** Those structures involved in ventilation and gas exchange *See also* lung
- response
- response loop** Control pathway that begins with the stimulus and ends with the response
- rest
- rest-and-digest
 - resting
 - resting ion permeability
 - resting membrane potential
 - resting membrane potential difference** The uneven distribution of ions across a living cell membrane
- resting metabolic rate (RMR)
- resting muscle
- resting potential
- resting skeletal muscle
- restrictive lung disease
- reticular
- reticular activating system** Neurons that contribute to arousal
- reticular cell
- reticular fiber
- reticular formation** Diffuse groups of neurons that branch from the brain stem into the brain and spinal cord; involved in muscle tone, stretch reflexes, coordination of breathing, blood pressure regulation, and modulation of pain
- reticulocyte** Immature red blood cell with no nucleus
- reticulocyte expelling nucleus
- reticuloendothelial system** Old term for tissue macrophages
- retina** Sensory receptors lining the posterior cavity of the eye
- retinal** The light-absorbing pigment of rhodopsin
- retinal photoreceptor
- retinal processing
- retinitis pigmentosa
- retrograde transport
- retroperitoneal
- retrospective study** Study that compares people with a disease to healthy controls
- reverse reaction
- reverse transcriptase** Viral enzyme that allows viral RNA to make the complementary DNA
- reversible interaction
- reversible reaction** A chemical reaction that can proceed in both directions
- review articles
- rheumatoid arthritis
- rhodopsin** Visual pigment of rods
- rhodopsin molecule
- rhodopsin receptor
- rhombin
- rhythmic movement
- rib
- rib cage
- ribonuclease
- ribose
- ribosomal RNA (rRNA)** Cytoplasmic RNA where assembly of proteins takes place
- ribosome** Small dense granules of RNA and protein that assemble amino acids into proteins
- ribs
- right atrium** Chamber of the heart that receives systemic venous blood
- right ventricle** Chamber of the heart that pumps blood to the lungs
- rigor mortis
- rigor state** Tight binding between actin and myosin in the absence of ATP
- rising phase
- RMR. *See* resting metabolic rate
- RNA (ribonucleic acid)** Nucleotide that interprets the genetic information stored in DNA and uses it to direct protein synthesis
- RNA induced silencing complex
- RNA interference (RNAi)
- RNA polymerase** Enzyme needed for synthesis of mRNA from DNA
- Rodbell, Martin
- rod-bipolar synapse
- rod** Receptors for monochromatic nighttime vision
- rod-shaped bacterium
- ROMK (potassium channel)
- roots
- ROS. *See* reactive oxygen species
- rostral
- rough endoplasmic reticulum (RER)** Organelle that is the primary site of protein synthesis
- round window** Membrane between cochlea and middle ear
- RQ. *See* respiratory quotient
- rRNA. *See* ribosomal RNA
- Ruffini corpuscle
- rugae** Surface folds in the interior of the stomach
- RV. *See* residual volume
- R wave** The largest wave of the QRS complex
- ryanodine receptor
- ryanodine receptor-channel (RyR)** Calcium-release channel of sarcoplasmic reticulum in striated muscles
- RyR. *See* ryanodine receptor
- S**
- S2 (second heart sound)
- sacculle** One of the otolith organs of the vestibular apparatus
- sacral spinal cord/nerves
- saline
- saliva** Watery enzyme and mucous secretions of the mouth
- salivary amylase
- salivary gland
- salivary gland acini
- salivary immunoglobulin
- Salmonella*
- salt
- salt and water balance. *See also* salt balance; water balance
- salt appetite
- saltatory conduction** The apparent leap-frogging of the action potential down myelinated axons
- salt balance. *See also* water balance
- salt excretion
- salt ingestion
- salt reabsorption
- SA node. *See also* sinoatrial node
- sarcolemma** The cell membrane of a muscle fiber
- sarcomere** The contractile unit of a myofibril
- sarcoplasmic reticulum** Modified endoplasmic reticulum in muscle that concentrates and stores Ca²⁺
- satellite cell** Glial cell that forms a supportive capsule around nerve cell bodies in ganglia
- satiety** A sensation of fullness
- satiety center** Hypothalamic center that decreases food intake
- saturated fatty acid** Fatty acid with no double bonds between carbons
- saturation** All active sites on a given amount of protein are filled with substrate and reaction rate is maximal
- of mediated transport
 - renal transport
- scaffold
- scala media. *See also* cochlear duct
- scala tympani. *See also* tympanic duct
- scala vestibuli. *See also* vestibular duct
- scalene muscle** Respiratory muscle than lifts the upper rib cage

Glossary/Index

- scanning electron micrographs (SEMs)
- scatter plot
- scavengers
- Schistosoma*
- schizophrenia
- Schmidt, Christine
- Schwann cell** Cell that forms myelin around a peripheral neuron axon
- Schwann cell nucleus
- scientific experiments
- Scientific Foundations for Future Physicians
- scientific theory
- sclera
- scrotal cavity
- scrotum** The external sac into which the testes descend so that they can stay cooler than body temperature
- seat of intelligence
- seat of the mind
- sebaceous gland
- secondary active transport** The energy for transport is the potential energy stored in a concentration gradient; indirectly depends on energy of ATP
- secondary bronchus
- secondary follicle
- secondary gametes
- secondary hypercortisolism
- secondary hypersecretion of cortisol
- secondary immune response** The stronger and more rapid immune response that occurs with the second or subsequent exposure to a pathogen,
- secondary indirect active transport
- secondary lymphoid tissues
- secondary neuron
- secondary oocyte** The ovulated egg which has gone through the first meiotic division
- secondary endocrine pathology** An endocrine pathology that arises in a trophic gland of a pathway
- secondary receptive field
- secondary respiratory center
- secondary sensory neuron** Spinal neurons that carry ascending information to the brain
- secondary sex characteristic** Features of the body, such as body shape, that distinguish males from females
- secondary spermatocyte** Spermatocyte that has gone through the first meiotic division
- secondary structure, of protein** Spatial arrangement of amino acids in the chain. Usually α -helix or β -pleated sheet
- second heart sound** Vibrations created when the semilunar valves close
- second law of thermodynamics** Natural processes move from an ordered state to a state of disorder known as entropy
- second meiotic division
- second meiotic division suspended
- second messenger** Intracellular molecules that translate the signal from a first messenger into an intracellular response
- second messenger activity
- second messenger molecule
- second messenger pathway
- second messenger system
- second-order neuron
- second polar body
- secrete antibodies
- secretin** Intestinal hormone that stimulates bicarbonate secretion and pepsin release; inhibits gastric acid secretion
- secretion** (1) The movement of selected molecules from the blood into the nephron; (2) The process by which a cell releases a substance into the extracellular space. *See also specific substance*
- exocrine
- GI tract, fluid entering by
- secretory cell
- secretory diarrhea
- secretory epithelia** Epithelia that secrete hormones or exocrine secretions
- secretory phase** Postovulatory phase of the uterus when it develops into a secretory structure
- secretory vesicles
- secretory vesicles of platelets
- segment
- segmental contractions
- segmental mixing
- segmentation
- selective estrogen receptor modulator (SERM)
- selectively permeable
- selectively permeable membrane** A membrane that allows some molecules to cross freely but excludes others
- selective serotonin reuptake inhibitor (SSRI)
- self-governing
- self-reactive cells
- self-tolerance** The lack of immune response to cells of the body
- Selye, Hans
- semen** Sperm plus secretions from accessory glands
- semicircular canal** Three fluid-filled canals of the vestibular apparatus that sense rotational movements
- semilunar valve** Heart valves between the ventricles and major arteries
- seminal vesicle** Male accessory glands that contribute enzymes and other secretions to semen
- seminiferous tubule** Region of the testes where sperm and hormones are produced
- sense organ
- sensitivity
- sensitization** Exposure to a noxious or intense stimulus creates an enhanced response upon subsequent exposure
- sensor
- sensorineural hearing loss
- sensory (afferent) neurons
- sensory afferent
- sensory area
- sensory coding
- sensory cortex
- sensory division
- sensory field
- sensory information
- sensory input
- sensory modality
- sensory nerve
- sensory nerve ending
- sensory neuron** A neuron that transmits sensory information to the central nervous system. *See also sensory receptor*
- axon of
- to hypothalamus
- sensory neuron ending
- sensory neuron input
- sensory neuron receptor
- sensory neuron signaling
- sensory pathway
- sensory physiology
- chemoreception
- ear, equilibrium
- ear, hearing
- eye and vision
- sensory systems
- somatic senses
- sensory receptor. *See also sensory neuron; specific type*
- stimuli
- types of
- sensory signal
- sensory stimuli
- sensory system. *See also specific sense*
- central nervous system (CNS)
- coding and processing
- general properties of
- receptors
- sensory neuron
- sensory transduction** Conversion of a sensory stimulus to an action potential
- separation of electrical charge
- septic shock
- septum** A dividing wall
- SER. *See* smooth endoplasmic reticulum
- series elastic element** Elastic fibers in the muscle that stretch during isometric contraction
- SERM. *See* selective estrogen receptor modulator
- serosa** Outer surface of the digestive tract created by a continuation of the peritoneum
- serosal membrane
- serosal membrane/surface. *See also basolateral membrane/surface*
- serosal surface
- serotonergic
- serotonin** A CNS neurotransmitter. Synonym: 5-hydroxytryptamine (5-HT)
- serous cell
- serous secretion** Watery exocrine solution that often contains enzymes
- Sertoli cell** Testicular cells that secrete anti-Müllerian hormone and support sperm production
- setpoint
- sex act
- sex chromosome
- sex determination
- sex drive. *See* libido
- sex hormone
- sexual development
- sexual differentiation
- sexual dysfunction
- sexual dimorphism** Males and females have different physical characteristics
- sexual response
- SGLT
- shallow breathing
- shivering thermogenesis
- shock** Generalized, severe circulatory failure
- short-loop negative feedback
- short reflexes
- short reflex secretion
- short-term energy storage
- short-term memory
- shoulder
- sickle cell disease
- sigmoid colon
- signal
- signal, nature of the

Glossary/Index

- signal amplification** Process by which a single signal molecule can generate multiple intracellular effector molecules
- signal cascade
- signaling mechanism
- signal ligands
- signal molecule. *See also* signal pathway
- signal molecule binding
- signal pathway. *See also* signal transduction
- signal processing
- signal rate
- signal sequence** Initial segment of a newly-made protein that directs the protein to the proper organelle for processing, packaging, and delivery
- signal transduction** The transmission of information from one side of a membrane to the other using membrane proteins
- signal transduction cascade
- signal transduction pathway
- signal transduction system
- signal transduction using ion channels
- signal transfer
- simple (one cell thick)
- simple brain
- simple diffusion** Diffusion across the phospholipid bilayer of a cell
- simple endocrine pathway
- simple endocrine reflex
- simple neural reflex
- simple pathway
- simple reflex pathway
- simple squamous epithelium
- Singer, S. J.
- single displacement reaction
- single-unit smooth muscle** Smooth muscle fibers that are electrically coupled by numerous gap junctions. *See also* visceral smooth muscle
- sinoatrial node (SA node)** A group of autorhythmic cells in the right atrium of the heart; the main pacemaker of the heart
- sinus
- sinusoid
- sister chromatid
- skeletal development
- skeletal muscle** Striated muscle usually attached to bones; responsible for positioning and movement of the skeleton
- comparison
- contraction. *See also* muscle contraction
- fibers
- load-velocity relationship in
- speed and fatigue resistance
- skeletal muscle fast-twitch fiber
- skeletal muscle fiber
- skeletal muscle movement
- skeletal muscle protein
- skeletal muscle pump
- skeletal muscle reflex
- skin. *See also* integumentary system
- skin cancer
- skin layer
- skull
- sleep
- sleep apnea
- sleep-awake cycle
- sleep cycle
- sliding filament theory of contraction** The current model for muscle contraction in which muscle proteins slide past each other to generate force
- slow axonal transport
- slow pain
- slow synaptic potential** Slower onset and longer lasting response of postsynaptic cells to certain neurotransmitters and neuromodulators ,
- slow-twitch fiber
- slow-twitch fiber segment
- slow-twitch muscle
- slow-twitch oxidative muscle
- slow wave
- slow wave potential** Cyclic depolarization and repolarization of membrane potential in smooth muscle
- slow-wave sleep
- small intestine** The segment of the gastrointestinal tract where most absorption and digestion take place
- small organic molecule
- smell
- smoking. *See also* nicotine
- smooth endoplasmic reticulum (SER)
- smooth muscle
- activity
- contraction
- membrane potential (mV)
- operate over a range of lengths
- organization
- relaxation
- smooth muscle contraction
- smooth muscle coordination
- sodium, *See also* sodium ion
- sodium balance
- sodium bicarbonate
- sodium chloride
- sodium chloride excretion
- sodium chloride secretion
- sodium chloride transport
- sodium-dependent transporter
- sodium-iodide symporter (NIS)** Transport protein for uptake of iodide into thyroid gland
- sodium ion
- and Ca²⁺ influx
- channel
- channel activation
- channel inactivation gate
- dependent cotransport
- sodium-linked reabsorption
- sodium-potassium ATPase (Na⁺-K⁺-ATPase)** Active transporter that moves Na⁺ out of the cell and K⁺ into the cell against their respective concentration gradients
- sodium-potassium pump
- sodium reabsorption
- soft palate
- soft tissue growth
- solubility** The ease with which a molecule or gas dissolves in a solution: The more easily a substance dissolves, the higher its solubility
- solute** Molecules that dissolve in liquid
- solute movement
- solute reabsorption
- solution** A solute or combination of solutes dissolved in solvent
- solvent** The liquid into which solutes dissolve. In biological solutions, water is the solvent
- soma. *See also* cell body
- somatic motor
- somatic motor division** Efferent branch of nervous system that controls skeletal muscles
- somatic motor neuron** Efferent neurons that control skeletal muscles
- somatic motor nuclei
- somatic motor pathway
- somatic motor reflex
- somatic motor response
- somatic perception
- somatic reflex
- somatic senses** Touch-pressure, temperature, pain, and proprioception
- cerebellum
- conscious stimulus processing
- cortex
- free nerve endings
- itch
- nociceptors
- pain
- protective responses
- somatic perception
- stimuli
- temperature receptors
- touch receptors
- somatic sensory nuclei
- somatic stimuli
- somatomedin** Old name for insulin-like growth factors
- somatosensory cortex. *See also* primary somatic sensory cortex
- somatosensory input
- somatosensory nerve fiber
- somatosensory pathway
- somatosensory receptor
- somatosensory tract** Axons carrying sensory information from the body to the brain
- somatostatin (hypothalamus)
- somatostatin** Hypothalamic hormone that inhibits growth hormone release and gastric paracrine that inhibits gastrin secretion
- somatostatin-secreting D cells
- somatotropin. *See also* growth hormone
- somatotropin release-inhibiting hormone (SRIH)
- somatropin release-inhibiting hormone (SRIH) *See* somatostatin
- sorting signal
- sound** The brain's interpretation of the amplitude, frequency, and duration of sound waves, *See also* hearing
- sound perception
- sound transduction
- sound transmission
- sound wave
- sound wave frequency
- sour
- spatial
- spatial summation** Summation of graded potentials from several sources
- spatial visualization

Glossary/Index

- specialized cell
- specialized receptor cell
- special senses** Vision, hearing, taste, smell, and equilibrium
- special sense receptor
- specific hunger** A craving for a particular substance such as salt
- specific immune response
- specificity** The ability of an enzyme or receptor to bind to a particular molecule or a group of closely related molecules
- speech center
- speed
- speed resistance
- sperm
- spermatid
- spermatogenesis
- spermatogonium
- spermatozoa. *See also* sperm
- sperm development
- sperm nucleus
- sperm production
- sphenoid bone
- spherocytosis
- sphincter. *See also specific type*
- sphincter of Oddi
- sphingolipid
- sphygmomanometer
- sphygmomanometry
- spike. *See also* action potential
- spinal accessory
- spinal accessory nerve
- spinal cord
- spinal cord integrating center
- spinal cord organization
- spinal nerve
- spinal reflex** A simple reflex that can be integrated within the spinal cord without input from the brain
- spinal tap
- spindle
- spindle sensory neuron
- spine, dendritic
- spirometer
- spirometry
- spleen
- splicing
- spoken communication
- sponge
- spongy bone. *See also* trabecular bone
- squamous
- squamous epithelium
- squid giant axon
- SRIH (somatropin release-inhibiting hormone). *See* somatostatin
- SRY gene** The sex-determining region on the Y chromosome
- SRY protein
- SS. *See* somatostatin
- SSRI. *See* selective serotonin reuptake inhibitor
- ST. *See* slow-twitch fiber
- stabilize
- stable fibrous plaque
- stable plaque
- stanols
- stapes** The third bone of the inner ear that connects the incus to the oval window
- starch** Digestible storage polysaccharide made by plants
- Starling, Ernest
- Starling curve
- Starling forces
- starting condition
- stasis
- stasis (suffix)
- static fluid
- steady pressure
- steady state
- stem cell** Immature cells that have the ability to differentiate
- stenotic valve
- stereocilia** Stiffened cilia of hair cells in the ear
- sterilization
- sternocleidomastoid
- sternocleidomastoid muscle** Inspiratory muscles that help elevate the upper ribs
- sternum
- steroid** Lipid-related molecules derived from cholesterol
- steroid hormone** Hormones made from cholesterol
- cellular mechanism of action of
- synthesis and release
- transport in the blood and half-life of
- steroidogenic factor (SF1)
- stethoscope
- stimuli
- mechanical
- nonpainful
- noxious
- sensory transduction
- touch receptors
- two-point discrimination
- stimulus** The disturbance or change that sets a reflex
- in motion
- duration
- intensity and duration
- location of the
- receptor adaption
- sensory receptor
- stimulus intensity
- stimulus point of origin
- stimulus processing
- stimulus properties
- stimulus strength
- St. Martin, Alexis
- stomach. *See also under gastric*
- acidity
- acid secretion in the
- digestive hormones
- lumens
- secretory cells and the mucus-bicarbonate barrier of the
- stomach balance digestion protection
- stomach lumen
- storage vesicle
- stored
- store-operated Ca²⁺ channel** Membrane Ca²⁺ channels that open when intracellular stores of Ca²⁺ are depleted
- stratified (multiple cell layer)
- streptokinase** An enzyme that dissolves blood clots
- stress
- and exercise
- stressor** An event that causes a stress reaction
- stress reaction
- stretch
- stretch receptor
- stretch reflex** A reflex pathway in which muscle stretch initiates a contraction response
- striated muscles** Muscles that appear to have alternating light and dark bands; includes skeletal and cardiac muscle
- striation
- stroke** Blockage or rupture of a blood vessel in the brain
- stroke volume** The amount of blood pumped by one ventricle during one contraction
- stroking movement
- stroma** Supporting connective tissue
- stroma of marrow
- strong pain
- structural protein
- structure
- structure-function map
- structure-function relationship
- stylized model
- subarachnoid space** Fluid-filled space beneath the arachnoid membrane of the skull
- subcellular compartmentation
- subclavian artery
- subconscious stimulus processing
- subdural space
- subendothelial extracellular matrix
- sublingual
- submandibular
- submandibular gland
- submucosa
- submucosal artery/vein
- submucosal gland
- submucosal plexus
- subpharyngeal ganglion
- substance P
- substantia nigra
- substrate** The ligand that binds to an enzyme or a membrane transporter
- subthreshold graded potential** A graded potential that is not strong enough to trigger an action potential
- subthreshold signal
- suckling
- sucrose** Disaccharide made from one glucose and one fructose. Synonym: table sugar
- surfactant
- sulci
- sulfate (SO₄²⁻)
- sulfhydryl group (-SH)
- sulfonylurea** Antidiabetic drug that stimulates insulin secretion by closing the KATP channel of beta cells
- summation
- summation of contractions
- superior canal
- superior thyroid artery
- superior vena cava
- superoxide** Oxygen molecule with an extra electron (•O₂⁻)
- superoxide anion
- support cell
- suprachiasmatic nucleus** Region of the hypothalamus believed to be the center for the biological clock
- supraoptic nuclei
- suprathreshold graded potential** A graded potential that is strong enough to trigger an action potential
- suprathreshold signal
- surface area
- Oxygen dissolved in plasma (Po₂ of plasma)
- surface epithelium

Glossary/Index

- surface receptor
- surface tension** The hydrogen bonds between water molecules that make it difficult to separate water molecules
- surfactant** Chemical that decreases the surface tension of water
- surfactant cell
- suspensory ligament
- sustentacular cell. *See also* Sertoli cell
- Sutherland, Earl
- swallowing
- swallowing reflex
- S wave
- sweat gland
- sweating
- sweat secretion
- sweet
- sympathetic activity
- sympathetic adrenergic neuron
- sympathetic branch** Division of the autonomic nervous system that is responsible for fight-or-flight response
- sympathetic chain
- sympathetic cholinergic neuron** Sympathetic neuron that uses ACh as a neurotransmitter
- sympathetic control
- sympathetic division
- sympathetic ganglia
- sympathetic ganglion
- sympathetic innervation
- sympathetic nerve
- sympathetic nervous system
- sympathetic neuroeffector junction
- sympathetic neuron (NE on $\alpha 1$ receptor)
- sympathetic neurons,
- sympathetic output
- sympathetic pathways
- sympathetic reflex
- sympathetic response
- sympathetic stimulation
- sympathetic target tissue
- symport carrier** A membrane transport protein that moves two or more molecules in the same direction across a membrane
- synapse. *See also* synaptic transmission
- synapse** Region where a neuron meets its target cell with tertiary sensory neuron
- synaptic activity
- synaptic cleft** The space between the pre- and postsynaptic cells
- synaptic communication
- synaptic connection
- synaptic knob. *See also* axon terminal
- synaptic plasticity
- synaptic potential
- synaptic terminal
- synaptic transmission
- synaptic vesicle** Small secretory vesicles that release neurotransmitter into the synapse
- syncytium
- syndrome
- synergism** Interaction of two or more hormones or drugs that yields a result that is more than additive
- synthetase
- systemic** Adjective referring to something that occurs body wide
- systemic arteries
- systemic capillaries
- systemic circulation** Portion of the circulation that carries blood to and from most tissues of the body
- systemic circulation pressure
- systemic metabolic effect
- systemic response
- systemic vein
- systems
- systole** The time when the heart is contracting
- systolic pressure** The highest pressures in the circulatory system that reflect the pressures created by contraction of the ventricles
- T
- T3 *See also* triiodothyronine
- T4 *See also* thyroxine
- tachycardia** Rapid heart rate
- tachypnea** Rapid breathing
- tactile stimuli
- tail (flagellum)
- tamoxifen** Drug that is a selective estrogen receptor, target
- target cell. *See also* effector
- target cell receptor
- target cell response
- target organ
- target protein
- target rece
- target response
- target synapse
- target tissue
- tastant
- taste
- taste bud
- taste cell
- taste ligand
- taste pore
- taste receptor
- taste transduction
- tau
- Tay-Sachs disease
- TBG. *See* thyroid-binding globulin
- TCA cycle (tricarboxylic acid cycle). *See* citric acid cycle
- TC cell. *See also* cytotoxic T cell
- T cell. *See also* T lymphocyte
- T-cell precursor
- T-cell receptor** Membrane receptors of T cells that bind to MHC-antigen complexes
- TDF. *See* testis determining factor
- TEA (tetraethylammonium)
- tear
- tear gland
- tectorial membrane** Membrane in the cochlea whose movement moves cilia of hair cells
- teeth
- teleological approach** Describing physiological processes by their purpose rather than their mechanism
- temperature,. *See also* body temperature
- hemoglobin's affinity for oxygen, effect of
- temperature control
- temperature homeostasis
- temperature regulation
- template strand
- temporal bone
- temporal lobe
- temporal summation** Summation of two stimuli that follow one another in time
- tendon** Connective tissue that attaches skeletal muscle to bone
- tenia coli** Muscle bands of the large intestine that pull the wall into haustra
- tension** The force created by a contracting muscle
- terminal cisternae** The ends of sarcoplasmic reticulum that abut the t-tubules
- terminal peptide bond
- termination of neurotransmitter activity
- tertiary active transport
- tertiary follicle
- tertiary indirect active transport
- tertiary neuron
- tertiary sensory neuron
- tertiary structure
- tertiary structure, of protein** Globular or fibrous three-dimensional shape of a protein molecule
- testes
- testicular feminizing syndrome
- testis** The male gonads
- testis-determining factor (TDF)** A protein that activates genes for male development
- testis-determining SRY protein
- testosterone** Steroid sex hormone, dominant in males
- tetanus** Sustained muscle contraction
- tetany
- tetraiodothyronine. *See also* thyroxine
- tetramer** Molecule with four subunits texture
- thalamus** Portion of the brain that serves as a relay station for information going to and from higher brain centers
- THC *See* 9-tetrahydrocannabinoid
- TH cell. *See also* helper T cell
- theca** Layer of cells in the follicle that secrete steroid hormones
- thecal cell
- The Man Who Mistook His Wife for a Hat and Other Clinical Tales*
- The Princess Bride*
- therapeutic drug
- thermodynamic
- thermogenesis
- thermoneutral zone** Temperature range within which energy from normal metabolism is sufficient to maintain normal body temperature
- thermoreceptor
- thermoregulation
- thermoregulatory center
- thermoregulatory reflex
- thick filament** An aggregation of myosin in muscle
- thin filament** An actin-containing filament of the myofibril
- third-degree block
- thirst. *See also* water balance
- thirst inhibition
- thirst stimulation
- thoracic
- thoracic cage** The ribs, sternum, spine, and attached muscles
- thoracic cavity
- thoracic duct
- thoracic portion
- thoracic spinal nerve
- thoracic volume
- thorax** The body cavity above the diaphragm

Glossary/Index

- threshold** (1) The minimum depolarization that will initiate an action potential in the trigger zone; (2) The minimum stimulus required to set a reflex response in motion
- threshold potential
- threshold voltage** Minimum depolarization required to initiate an action potential
- thrombin** Plasma protein that converts fibrinogen into fibrin
- thrombin formation
- thrombocyte** Alternate name for platelets. *See also* platelet
- thromboplastin
- thromboplastin, tissue. *See* tissue factor
- thrombopoietin (TPO)** Cytokine that promotes platelet formation
- thromboxane
- thromboxane A₂
- thrombus** A blood clot that adheres to the wall of a blood vessel
- thymine
- thymopoietin** Hormone made in thymus gland that promotes lymphocyte formation
- thymosin** Hormone made in thymus gland that promotes lymphocyte formation
- thymulin
- thymus
- thymus gland** Immune tissue that produces lymphocytes
- thyroglobulin** Large protein on which thyroid hormones are formed
- thyroid artery
- thyroid-binding globulin (TBG)
- thyroid cell
- thyroid follicle
- thyroid follicle cell
- thyroid gland** Endocrine gland in the neck that produces thyroid hormones
- thyroid hormone. *See* triiodothyronine and iodine
- thyroid hormone control pathway
- thyroid hormone synthesis
- thyroid pathologies
- thyroid peroxidase
- thyroid-stimulating hormone
- thyroid-stimulating immune protein
- thyroid-stimulating immunoglobulin
- thyronine
- thyrotropin (TSH)
- thyrotropin-releasing hormone (TRH)
- thyroxine (T₄)
- thyroxine-binding globulin (TBG)** Plasma protein that serves as carrier for thyroid hormones
- tidal volume (V_T)** The volume of air that moves in a single normal inspiration or expiration
- tight junction** Cell-to-cell junction in epithelia that does not allow much movement of material between the cells
- time (alveolar pressure)
- time constant
- timing
- timing difference
- tip link
- tissue** A collection of cells, usually held together by cell junctions, that works together to achieve a common purpose. *See also specific type*
- of the body
 - gas exchange in the
 - heart damage
 - hemoglobin transport of oxygen to the
 - liver damage
 - local control
 - loss
 - multiple
 - red blood cell damage
 - skeletal muscle damage
 - structure of connective tissue and bone growth
- tissue damage
- tissue factor** A protein-phospholipid mixture released by damaged blood vessel walls
- tissue factor III
- tissue formation
- tissue growth
- tissue growth and hormone
- tissue macrophage
- tissue membrane
- tissue metabolism
- tissue morphology
- tissue plasminogen activator (tPA)** An molecule that promotes dissolution of blood clots
- tissue remodeling
- tissue repair
- tissue response
- tissue responsiveness
- tissue thromboplastin. *See also* tissue factor
- titin** Elastic giant protein that maintains spatial structure of myofibrils
- TK. *See* tyrosine kinase
- TLC. *See* total lung capacity
- T lymphocyte (T cell)** Immune cells that bind to and kill their target cells
- T lymphocyte activation
- T lymphocyte development
- T lymphocyte receptor
- T_m. *See* transport maximum
- TNF. *See* tumor necrosis factor
- toll-like receptors (TLRs)
- tone. *See* muscle tone
- tongue
- tongue muscle
- tonic activity
- tonically active
- tonically active sensory neuron
- tonic contraction
- tonic control** Ongoing control that is adjusted up and down
- tonic discharge
- tonic input
- tonicity
- tonic level
- tonic receptor** Slowly adapting receptors
- tonic release
- tonic secretion
- tonic signal
- tonic smooth muscle
- tonsil
- torque
- torr
- total alveolar ventilation
- total body
- total body calcium
- total body water
- total cross-sectional area
- total lung capacity (TLC)** Vital capacity plus residual volume
- total peripheral resistance (TPR)
- total pulmonary ventilation** The volume of air moved in and out of the lungs each minute
- total white cell count
- totipotent** A stem cell that can develop into a functioning organism
- touch
- touch receptor
- tPA. *See* tissue plasminogen activator
- TPO. *See* thrombopoietin
- trabecular bone** Spongy bone with many open spaces
- trace element** Essential element required in small amounts
- trachea** Main airway of the respiratory system
- tract** Bundles of axons in the CNS, generally with a common origin and destination
- transamination** Transfer of an amino group from one molecule to another
- transcellular transport
- transcription** Transfer of information coded in DNA to mRNA
- in the nucleus
- transcription factors** Regulatory proteins that bind to DNA and alter gene expression
- transcytosis** A combination of endocytosis, vesicular transport across the cell, and exocytosis; used to move macromolecules across an epithelium
- transducer
- transducin** G protein that mediates bitter taste and photoreceptor transduction
- transduction** Conversion of a signal from one modality to another. *See also* phototransduction; signal transduction
- transduction pathway
- transduction site
- transepithelial transport. *See also* epithelial transport
- transferrin** Plasma protein that binds and transports iron
- transferrin protein transport
- transfer RNA (tRNA)** RNA that binds to an amino acid on one end and to ribosomal RNA at the other
- transforming growth factor- β
- transfusion. *See* blood transfusion
- transgenic mouse** A mouse whose DNA has been altered to contain additional genes that are not normally present
- transient receptor potential (TRP)
- transient receptor potential V₁ (TRPV₁)
- translation** Conversion of the message carried by mRNA into a peptide chain
- translational research** applies basic biomedical research findings to treatment and prevention of human diseases
- transmembrane protein
- transport
- transporter. *See also* carrier protein; channel protein
- transporter gene families
- transporting epithelia** Epithelium whose primary function is the movement of solutes and water between two compartments
- transport maximum (Tm)** The maximum transport rate that occurs when all carriers are saturated
- transport process
- transport protein. *See also* carrier protein; channel protein
- transport rate
- transport vesicle** Vesicles that shuttle their contents from endoplasmic reticulum to the Golgi apparatus
- transport work
- transverse colon

Glossary/Index

- transverse tubule (t-tubules)** Invaginations of the muscle fiber membrane, associated with the sarcoplasmic reticulum
- TRH. *See* thyrotropin-releasing hormone
- triacylglycerol. *See also* triglyceride
- triad** One t-tubule with its flanking terminal cisternae
- tricarboxylic acid cycle. *See* citric acid cycle
- triceps
- triceps brachii
- tricuspid (right AV) valve
- tricuspid valve** The right AV valve of the heart
- tricyclic antidepressant
- trigeminal
- trigeminal nerve
- trigger zone** The region of the axon where graded potentials are integrated and an action potential begins if the signal is above threshold
- triglyceride** Lipid composed of one glycerol and three fatty acids. *Synonym:* triacylglycerol
- triglyceride synthesis
- triiodothyronine (T3)** Most active form of thyroid hormone; produced mostly in peripheral tissues from T4
- tRNA. *See* transfer RNA
- trochlear
- trophic
- trophic hormone** Any hormone that controls the secretion of another hormone
- tropic hormone. *See* trophic hormone
- tropin (suffix)
- tropomyosin** A regulatory protein that blocks the myosin-binding site on actin
- tropoinin** Complex of three proteins associated with tropomyosin
- tropoinin C
- TRPV₁ channel. *See* transient receptor potential V₁ (TRPV₁) channel
- trunk
- trypsin** Enzyme that digests proteins
- trypsinogen** Inactive form of trypsin
- tryptophan** Amino acid from which the hormone melatonin is made
- TSH receptor
- TSH (thyroid-stimulating hormone). *See* thyrotropin
- TSI. *See* thyroid-stimulating immunoglobulin
- T-tubule. *See also* transverse tubule
- TTX. *See* tetrodotoxin
- tubal ligation
- tubular element
- tubular epithelium
- tubular reabsorption
- tubule
- tubule lumen
- tubulin
- tubuloglomerular feedback** The process by which changes in fluid flow through the distal tubule influence glomerular filtration rate
- tumor. *See also* cancer
- tumor cell
- tumor necrosis factor (TNF)
- tunica intima
- tuning fork
- T wave** ECG wave that represents ventricular repolarization
- twitch** A single contraction/relaxation cycle in a muscle fiber
- two-point discrimination test
- 2010 Advanced Placement Biology Curriculum (College Board)
- tympanic duct (perilymph)
- tympanic membrane
- type. *See* slow-twitch fibers
- type 1 diabetes mellitus
- type 2 diabetes mellitus
- type I alveolar cell** Thin alveolar cells for gas exchange
- type IIA. *See* fast-twitch oxidative-glycolytic fibers
- type II alveolar cell** Alveolar cells that synthesize and secrete surfactant
- type IIB. *See* fast-twitch glycolytic fibers
- type III taste cells
- type II taste cell
- type I support cell
- tyrosine** Amino acid that is the basis for thyroid hormones and the catecholamines
- tyrosine derivative
- tyrosine kinase (TK)** Membrane enzyme that adds a phosphate group to the tyrosine residue of a cytoplasmic protein, enhancing or inhibiting its activity
- tyrosine kinase activity
- tyrosine kinase receptor
- ### U
- ubiquitin** Protein that tags molecules for destruction by proteasomes
- ultra-short-loop feedback
- umami** The taste sensation triggered by glutamate and associated with nutritious food
- umbilical arteries
- umbilical cord
- umbilical vein
- unbound hormone
- undershoot
- under-ventilated alveoli
- unfused tetanus
- uninucleate
- uniport carrier** A membrane transport protein that moves only one kind of molecule
- unitary smooth muscle. *See also* visceral smooth muscle
- United States National Institutes of Health
- universal gas constant
- unmyelinated axon
- unmyelinated axon membrane
- unmyelinated fiber
- unmyelinated nerve ending
- unregulated heat
- unsaturated fatty acid** Fatty acid with one or more double bonds between carbons
- unstable plaque
- up and down-regulation
- upper esophageal sphincter
- upper eyelid
- upper respiratory infections (URIs)
- upper respiratory system
- upper respiratory tract
- up-regulation** Increase in protein number or binding affinity that increases the response of the target cell
- uracil
- urate
- urate transporter (UAT)
- urate transporter 1 (URAT1)
- urea** Nitrogenous waste product produced from amino groups
- urea and medullary interstitium
- urea clearance
- urea molecule
- urea production
- ureter** Tube that links a kidney to the urinary bladder
- urethra** Single tube that drains urine from the bladder to the external environment
- urethral fold
- urethral groove
- urethral opening
- uric acid** Nitrogenous waste product
- uricosuric
- urinalysis
- urinary
- urinary bladder
- urinary bladder control
- urinary excretion
- urinary system** The kidneys, bladder, and accessory structures. *See also specific structure*
- urinary tract infections (UTI)
- urination. *See* micturition
- urine** Fluid waste product produced by the kidneys
- urine acidification
- urine osmolarity
- urobilinogen
- urocortin
- U.S. Food and Drug Administration (FDA)
- uterine artery
- uterine cavity
- uterine contraction
- uterine cycle
- uterine muscle
- uterine wall
- uterus,
- utricle** One of the otolith organs of the vestibular apparatus
- UV rays
- ### V
- V2 receptor
- vagal
- vagal reflex
- vagina
- vaginal opening
- vagotomy** Operation that severs the vagus nerve,
- vagus
- vagus nerve** Cranial nerve that carries sensory information and efferent signals to many internal organs including the heart and GI tract
- Valsalva maneuver** Abdominal contraction and forced expiratory movement against a closed glottis valve, heart. *See also specific valve*
- valvular stenosis
- van der Waals force** Weak attractive force that occurs between two polar molecules or a polar molecule and an ion
- vanilloid receptor
- variability
- variable resistance
- varicosity** Swollen regions along autonomic axons that store and release neurotransmitter
- vasa recta** Peritubular capillaries in the kidney that dip into the medulla and then go back up to the cortex, forming hairpin loops
- vascular
- vascular elements of the kidney
- vascular endothelial growth factor (VEGF)** Growth factors that regulate angiogenesis
- vascular endothelium
- vascular permeability
- vascular smooth muscle** The smooth muscle of blood vessels
- vascular tissue

Glossary/Index

- vasculature** The blood vessels *See also* blood vessel
- vas deferens** Tube that carries sperm from the epididymis to the urethra. Synonym: ductus deferens
- vasectomy
- vasoactive intestinal peptide
- vasoconstriction** Contraction of circular vascular smooth muscle that narrows the lumen of a blood vessel
- vasodilation** Relaxation of circular vascular smooth muscle that widens the lumen of a blood vessel
- vasopressin. *See also* antidiuretic hormone
- inhibition
- receptor
- release
- secretion
- and water reabsorption
- vasopressin, arginine (AVP)
- vasovagal syncope** Fainting due to a sudden decrease in blood pressure as a result of an emotional stimulus
- VC. *See* vital capacity
- vector arrow
- vector of current flow
- vector of the electrical current flow
- vegetative nervous system. *See also* autonomic nervous system
- vein** Blood vessels that return blood to the heart
- AVP release into the blood
- spleen
- uterus
- velocity
- velocity of flow** The distance a fixed volume will travel in a given period of time
- velocity of shortening
- vena cava
- venipuncture
- venous blood
- venous blood vessel
- venous circulation
- venous constriction
- venous O₂ transport
- venous Po₂
- venous return** The amount of blood that enters the heart from the venous circulation
- venous sinus
- venous valve
- ventilation** The movement of air between the atmosphere and the lungs
- carbon dioxide, oxygen, and pH influence on and exercise
- higher brain centers affect patterns of
- pH disturbances, compensates for
- rate
- reflex control of
- regulation of exchange with the environment
- ventilation-perfusion
- ventilatory response
- ventral
- ventral horn** Region of the spinal cord that contains efferent nuclei
- ventral nerve cord
- ventral respiratory group (VRG)** Medullary neurons for active expiration and greater-than-normal inspiration
- ventral root** Section of a spinal nerve that carries information from the central nervous system to the muscles and glands
- ventral tegmental area
- ventricle
- ventricular cell
- ventricular conducting system
- ventricular contraction
- ventricular depolarization
- ventricular diastole
- ventricular ejection
- ventricular end-diastolic volume (ml)
- ventricular fibrillation
- ventricular filling
- ventricular muscle
- ventricular myocardium
- ventricular pressure
- ventricular relaxation
- ventricular repolarization
- ventricular stretch
- ventricular systole
- ventricular volume (mL)
- vesicle** A sac-like, membrane-bound organelle used for storage and transport
- vertebrae
- vertebral column
- vertigo
- very-low-density lipoprotein (VLDL)
- vesicle
- vesicular transport** The movement of vesicles within the cell with the aid of the cytoskeleton
- vessel. *See also* specific vessel
- vessel constriction
- vessel dilation
- vestibular apparatus** Portion of the inner ear that contains sensory receptors for balance and equilibrium
- vestibular branch of vestibulocochlear nerve (VIII)
- vestibular disorder. *See* Ménière's disease
- vestibular duct (perilymph)
- vestibular nerve
- vestibular nuclei
- vestibulocochlear
- vestibulocochlear nerve
- vibration
- Vibrio cholerae*
- villi** Fingerlike projections of the intestinal surface
- villus
- VIP. *See* vasoactive intestinal peptide
- viral antigen
- viral infection
- viral replication
- viral reproduction
- viral structure
- virus
- virus replication
- viscera
- visceral function
- visceral muscle
- visceral nervous system. *See also* autonomic nervous system
- visceral pain
- visceral pleura
- visceral reflex
- visceral sensory nuclei
- visceral smooth muscle
- visceral stimuli
- viscosity** Thickness or resistance to flow of a solution
- visible light
- vision
- defects
- neutral pathway for
- pathways
- special senses
- visual association area
- visual cortex** Region of the cerebral cortex that processes visual information
- visual field
- visualization technique
- visual pigment** Retinal pigment that converts light energy to a change in membrane potential
- vital capacity (VC)** The maximum amount of air that can be voluntarily moved in and out of the respiratory system
- vitamin** Nutrient needed in small amounts to serve as a cofactor or coenzyme
- by active transport
- vitamin B₁₂** Vitamin needed for red blood cell synthesis
- vitamin B₁₂ deficiency
- vitamin C
- vitamin D
- vitamin D₃. *See also* calcitriol
- vitamin D synthesis
- vitamin K
- vitreous body (vitreous humor)** Gelatinous matrix that fills the eye chamber behind the lens
- vitreous chamber
- vitreous humor
- VLDL. *See* very low-density lipoprotein
- Vm. *See* membrane potential
- VNO. *See* vomeronasal organ
- Vo_{2max}. *See* maximal rate of oxygen consumption
- vocal cord
- vocalization
- voltage change
- voltage-gated Ca²⁺ channel
- voltage-gated channel** A gated channel that opens or closes in response to a change in membrane potential. *See also* specific type
- voltage-gated channel K⁺
- voltage-gated ion channel
- voltage-gated Na⁺ channel
- voltage-sensitive protein
- voltmeter
- volume
- of air moved
- conserved
- disturbances in
- expressions of
- integrated control of
- responses triggered by changes in
- salt ingestion
- volume receptor
- volume reservoir
- volume/volume solution
- voluntary breath-holding
- voluntary control
- voluntary movement
- vomeronasal organ (VNO)** An olfactory structure linked to pheromone reception in rodents
- vomiting
- vomit
- von Willebrand factor (vWF)
- VRG. *See* ventral respiratory group
- VT. *See* tidal volume
- vulnerable plaque
- vulva** The external female genitalia
- vWF, von Willebrand factor

Glossary/Index

W

warming
warm receptor
waste
waste heat
water
 absorption
 collecting duct permeability
 crypt cells secrete ions and
 digestive system secretion
 excretion
 gain
 intake
 intestine absorption of
 loss
 Membrane attack complex
 by osmosis
 paracellular movement
 as polar molecule
 reabsorption
 solute
 solutions in
water absorption
water balance. *See also* sodium balance
water channel
water content, percentage of body weight
water excretion
water intake
water molecule
water pore
water vapor
watery secretion

wave
wavelength
weight loss
weight/volume solution
Wernicke's area One of the speech centers of the brain
wheal
white blood cell. *See also* leukocyte
white cell
white fat Adipose cells that typically contain a single enormous lipid droplet that occupies most of the volume of the cell
white matter Central nervous system tissue composed primarily of myelinated axons
white muscle Muscle with fewer mitochondria that uses primarily anaerobic glycolysis
white pulp
whooping cough
Wigger's diagram
Wilms' tumor protein (WT1)
wind chill factor
withdrawal reflex
Wolffian duct Embryonic structures that develop into male reproductive structures
womb. *See* uterus
Woods, Tiger
work
work (biological systems)
working memory A form of short-term memory
writing
written communication

X

X chromosome Female sex chromosome
xenobiotic

X-linked inherited chromosome

Y

Y chromosome Male sex chromosome

yolk sac

Z

Z disk Sarcomere proteins to which actin filaments attach

zinc

Zollinger-Ellison syndrome

zona fasciculata Middle zone of adrenal cortex that synthesizes glucocorticoids

zona glomerulosa Outer zone of adrenal cortex that synthesizes aldosterone

zona pellucida Protective glycoprotein coat around an ovum

zona reticularis Inner zone of adrenal cortex that synthesizes sex steroids

zonules Fibers that attach the lens of the eye and change its shape

zwischen

zygote Fertilized egg

zygote nucleus

zymogen Inactive proenzymes in the digestive system

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