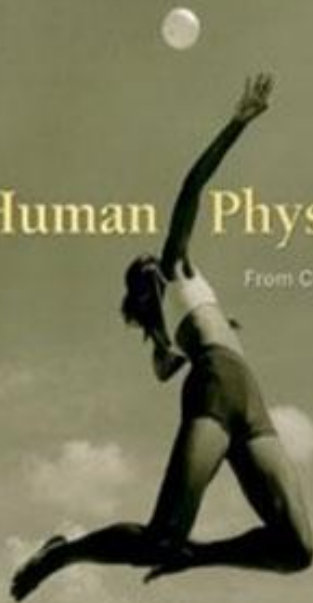


SOLUTIONS MANUAL



Human Physiology Sixth Edition

From Cells to Systems



Lauralee Sherwood

Chapter 2

Cellular Physiology

CHAPTER OUTLINE

OBSERVATIONS OF CELLS

AN OVERVIEW OF CELL STRUCTURE

The plasma membrane bounds the cell.
The nucleus contains the DNA.
The cytoplasm consists of various organelles and the cytosol.

ENDOPLASMIC RETICULUM AND SEGREGATED SYNTHESIS

The rough endoplasmic reticulum synthesizes proteins for secretion and membrane construction.
The smooth endoplasmic reticulum packages new proteins in transport vesicles.

GOLGI COMPLEX AND EXOCYTOSIS

Transport vesicles carry their cargo to the Golgi complex for further processing.
The Golgi complex packages secretory vesicles for release by exocytosis.

LYSOSOMES AND ENDOCYTOSIS

Lysosomes serve as the intracellular digestive system.
Extracellular material is brought into the cell by phagocytosis for attack by lysosomal enzymes.
Lysosomes remove useless parts of the cell.

PEROXISOMES AND DETOXIFICATION

Peroxisomes house oxidative enzymes that detoxify various wastes.

MITOCHONDRIA AND ATP PRODUCTION

Mitochondria, the energy organelles, are enclosed by a double membrane.
Mitochondria play a major role in generating ATP.
The cell generates more energy in aerobic than in anaerobic conditions.
A Closer Look at Exercise Physiology Aerobic Exercise: What For and How Much?
The energy stored in ATP is used for synthesis, transport, and mechanical work.

VAULTS AS CELLULAR TRUCKS

Vaults may serve as cellular transport vehicles.

CYTOSOL: CELL GEL

The cytosol is important in intermediary metabolism, ribosomal protein synthesis, and nutrient storage.

CYTOSKELETON: CELL “BONE AND MUSCLE”

Microtubules help maintain asymmetrical cell shapes and play a role in complex cell movements.
Microfilaments are important to cellular contractile systems and as mechanical stiffeners.
Intermediate filaments are important in cell regions subject to mechanical stress.
The cytoskeleton functions as an integral whole and links other parts of the cell together.

PHYSIOEDGE ACTIVITIES

Related to Text:

Tutorial - Transport Across Membranes
Media Exercise 2.1: Anatomy of a Generic Cell
Media Exercise 2.2: Basic Functions of Organelles

Related to Figures:

Figure 2.1. For an interaction related to this figure, see Media Exercise 2.1: Anatomy of a Generic Cell.

Figure 2.2. For an animation of this figure, click the Exocytosis tab in the Transport Across Membranes tutorial.

Figure 2.8. For an animation of this figure, click the Endocytosis tab in the Transport Across Membranes tutorial.

LIST OF KEY TERMS

actin	cytosol	NAD
adenosine diphosphate (ADP)	deoxyribonucleic acid (DNA)	nuclear envelope
adenosine triphosphate (ATP)	ectoplasm	nucleus
adipose tissue	electron transport chain	peroxisomes
aerobic	endocytic vesicles	nuclear pores
aerobic exercise	endoplasmic reticulum	oxidative enzymes
amoeboid movement	exocytosis	oxidative phosphorylation
amyotrophic lateral sclerosis (ALS)	flagellum	phagocytosis
anaerobic	glycogen	pinocytosis
anaerobic exercise	guanosine diphosphate (GDP)	plasma membrane
ATP synthase	guanosine triphosphate (GTP)	pseudopod
autophagy	hydrogen peroxide	receptor-mediated endocytosis
basal body	inclusions	ribonucleic acid (RNA)
catalase	kinesin	rough ER
cell membrane	Lou Gehrig's disease	ribosomal RNA
chemiosmotic mechanism	lysosomes	Tay-sachs disease
cilia	matrix	transport vesicles
cristae	messenger RNA (mRNA)	smooth ER
cytoplasm	metabolism	transfer RNA
cytoskeleton	microtubules	tubulin
	microvilli	vaults

LECTURE HINTS AND SUGGESTIONS

1. Slides, transparencies, and electron micrographs are very useful for pointing out the major features of cells and organelles. These can be obtained from Carolina Biological Supply Company, Burlington, NC. Numerous WWW resources are also available such as <http://www.cellbio.com>.
2. Demonstrate a model of a cell and the different organelles. Encourage students to think of cells as highly dynamic, three dimensional entities.
3. Biology supply houses also furnish charts of cell structures. Display these charts to enhance your lectures on this topic. Also display them in lab when students study cells.
4. Use a video microscope to show living cells or preserved specimens.
5. If you have internet connections in the classroom, a variety of video clips and slides are available at the sites listed below.
6. Students enjoy the "Cell Game" available from Carolina Biological Supply.
7. Demonstrate osmotic properties by using dialysis membranes or osmometers, which are available from biological supply companies.

8. The importance of ATP in living systems can be easily demonstrated using fireflies. Kits are available from biological supply companies.
9. Be sure to remind students of the learning resources available on the textbook website, PhysioEdge CD-ROM, and literature searching capability of InfoTrac®.

AUDIOVISUAL AIDS

Videos/Films

The following are films that may be suitable for presentation in your class. The sources for these films, which are coded by abbreviation, are provided in Appendix A.

Anatomy and Physiology Video Tutor, PH
 Biological Membranes, PS, 17 min.
 Biology Concepts: cellular respiration, CBS, 39 min.
 The Building Blocks of Life, CBS, 60 min.
 The Cell, CE, 14 min.
 The Cell: Basic Unit of Life, EVN, 18 min. Cell Biology: Life Functions, COR, 20 min.
 Cell Biology: Structure and Composition, COR, 13 min.
 Cell Motility and Microtubules, FHS, 30 min.
 Cell Motility, EI
 Cell Organelles and Transport, CE, 14 min.
 Cell Structure , (VCR), MG, 24 min.
 Cell Structure, PS, 25 min.
 The Cell, A Functioning Structure, Parts I and II, CCM, 30 min.
 The Cell: Parts I and II, MH, 16 min.
 The Cell: Structural Unit of Life, COR, 11 min.
 Cell: Unit of Life, PLP, 15 min.
 Cells and Energy, CE, 14 min.
 Cellular Respiration: Energy for Life. CBS, 22 min.
 Concepts in Science: Cellular Respiration, CBS, 60 min.
 The Embattled Cell, WFL, 20 min.
 Glycolysis 1 and 2, FHS, 10 min. each
 Inside the Cell, IM, 45 min.
 Introduction to Cell Structure, IM, 34 min.
 Introduction to Cells, EI, 30 min.
 Introduction to Living Cells, PLP, 18 min.
 Journey through the Cell 2 parts, CE, 20 min. each
 The Kreb's Cycle, FHS, 10 min.
 Learning about Cells, EBE, 16 min.
 The Life and Death of a Cell, UC, 27 min.
 The Living Cell: An Introduction, EBE, 20 min.
 The Magic of Cells, AV, 20 min.
 Oxidative Phosphorylation, FHS, 10 min.
 Understanding the Cell, EVN, 17 min.
 Understanding Cell Membranes, EVN, 32 min.
 Visualizing Cell Processes: Cell Movement and Transport, CBS, 13 min.
 Visualizing Cell Processes: Photosynthesis and Cellular Respiration, 12 min.
 The Unit of Life, MH, 28 min.

Software

Cells alive!, QG, a CD that explores cell structure in video and animations.
 Cell Biology Biodiscs CD, BIO, a series of 13 CDs on cell biology.
 Cell City, CE. an innovative CD that explains the operations of a cell.
 Cell Structure and Function, EI, presents an overview of the animal cell.
 Cell Structure and Function, CY, an interactive CD.

Cell Structure and Specialization Set, CBS, five CDs covering cells.
Cells, CBS, covers the cell theory and differences between plant and animal cells.
Cellular Respiration, CY, an interactive CD.
Cellular Respiration, PLP, an interactive CD.
Energy and the Chemistry of Life, CBS, CD Mac/Win.
Inside the Cell, Cyber Ed, www.cyber-ed.com.
Learning About Cells and Biology, EDI, an illustrated CD on cell structure and function.
MediaPhys CD-Rom, MH, covers most body systems.
The Plasma Membrane & Cellular Transport, CY, an interactive CD.
The Study of the Cell, PLP, an interactive CD.

Relevant Educational Websites

<http://www.cellbioed.org/> (Cell Biology Education A Journal of Life Science Education)
<http://ajpcon.physiology.org/> (American Journal of Physiology)
<http://personal.tmlp.com/Jimr57/textbook/chapter3/chapter3.htm> (The Virtual Cell textbook)
<http://www.nrcam.uchc.edu/> (National Resource for Cell Analysis and Modeling)
<http://www.porterendowment.org/> (cell biology educational resources Endowment for Cell Biology)
<http://www.interscience.wiley.com/jpages/0021-9541/> (Journal of Cellular Physiology)
<http://www.cellsalive.com> (Online videos/animations of cells)
<http://www.life.uiuc.edu/cgi-bin/plantbio/cell/cell.cgi> (Virtual plant cell)
<http://link.springer.de/link/service/journals/00418/index.htm> (Histochemistry and Cell Biology Journal)
<http://www.cell.com> (Cell online journal; searchable)
<http://www.cellbio.com> (Cell and Molecular Biology Online)
http://www.biology.arizona.edu/cell_bio/cell_bio.html (The Biology Project: Cell Biology)
<http://library.thinkquest.org/3564> (The Cell website)
<http://arnica.csustan.edu/site.asp> (Department of Biological Sciences, CA State University)
<http://www.med.uc.edu/medware2> (Movies and labs)
<http://web.mit.edu/esgbio/www/cb/cbdir.html> (Cell Biology text online)
<http://www.sp.uconn.edu/~terry/images/anim/ETS.html> (Animation of electron transport)

Relevant Organizations providing educational resources

American Society for Biochemistry and Molecular Biology
9650 Rockville Pike
Bethesda, MD 20814-3996
<http://www.asbmb.org>

American Society for Cell Biology
8120 Woodmont Ave, Suite 750
Bethesda, MD 20814-2762
<http://www.ascb.org>

American Society of Cytopathology
400 West 9th Street, Suite 201
Wilmington, Delaware 19801
<http://www.cytopathology.org/>

British Society for Cell Biology
c/o M. Clements, Department of Zoology
Downing St., Cambridge CB2 3EJ, UK
<http://www.bsceb.org>

Canadian Society of Biochemistry and Molecular and Cell Biology
<http://www.csbmcb.ca/>

International Federation for Cell Biology
<http://www.ifcbiol.org/>

International Society for Analytical Cytology
60 Revere Drive, Suite 500
Northbrook, IL 60062-1577
(847)-205-4722
<http://www.isac-net.org/>

THOMSON MEDIA RESOURCES

PhysioEdge CD-ROM

For a visual review of concepts in this chapter, check out:

Tutorial: Transport across Membranes
Media Exercise 2.1: Anatomy of a Generic Cell
Media Exercise 2.2: Basic Functions of Organelles

Book Companion Website

The website for this book contains a wealth of helpful study aids, as well as many ideas for further reading and research. Log on to:

<http://www.brookscole.com/sherwoodhp6>

Select Chapter 2 from the drop-down menu, or click on one of the many resource areas.

For Suggested Readings, consult **InfoTrac® College Edition/Research** on the PhysioEdge website or go directly to InfoTrac® College Edition, your online research library, at:

<http://infotrac.thomsonlearning.com>

