

P r e f a c e

The text, which is based on the eighth edition of *Pathophysiology: Concepts of Altered Health*, has been prepared specifically for those students who do not need the extensive breadth or detail of content provided in the larger book. To accomplish this task, content deemed to be less essential has been omitted, while essential content has been reorganized, revised, and condensed.

The integration of full color into the design and illustrations from the eighth edition has been carried over into the third edition of the essentials version. Over 200 of the illustrations that appear in this edition are new or have been extensively modified. The illustrations—line drawings of anatomic structures and pathophysiologic processes, flow charts, and photographic illustrations of disease states—have been carefully chosen to support the concepts that are presented in the text. This offers not only visual appeal but also enhances conceptual learning, linking text content to illustration content. A new element, the “clinical feature,” uses illustration to depict the clinical manifestations of selected disease states.

The third edition also retains the list of suffixes and prefixes, the glossary, and the table of normal laboratory values that were in the previous edition. The table of laboratory values includes conventional and SI units, as well as conversion units and internet addresses for additional information. The key concept boxes have been retained within each chapter. They are intended to help the reader retain and use text information by providing a mechanism to incorporate the information into a larger conceptual unit as opposed to merely memorizing a string of facts. Review exercises appear at the end of each chapter and assist the reader in using the conceptual approach to solving problems related to chapter content.

Along with the extensive changes and revision, every attempt has been made to present content in a manner that is logical, understandable, and that inspires reader interest. The content has been arranged so that concepts build on one another, with concepts from physiology, biochemistry, physics, and other sciences reviewed as deemed appropriate. A conceptual model that integrates the developmental and preventative aspects of health has been used. Selection of content was based on common health problems, including the special needs of children, pregnant women, and elderly persons. Although first and foremost intended as a course textbook, it also serves as a reference book that students can take with them and use in their practice once the course is finished.

And finally, as a nurse–physiologist, my major emphasis with each edition has been to relate normal body functioning to the physiologic changes that participate in disease production and occur as a result of disease, as well as the body’s remarkable ability to compensate for these changes. The beauty of physiology is that it integrates all of the aspects of human genetics, molecular and cellular biology, and organ anatomy and physiology into a functional whole that can be used to explain both the

physical and psychological aspects of altered health. Indeed, it has been my philosophy to share the beauty of the human body and to emphasize that in disease as in health, there is more “going right” in the body than is “going wrong.” This book is an extension of my career and, as such, of my philosophy. It is my hope that readers will learn to appreciate the marvelous potential of the body, incorporating it into their own philosophy and ultimately sharing it with their clients.

Carol Mattson Porth

Student and Instructor Resources

Student Resources

The student resource DVD accompanying this text contains several useful study resources including

- **Animations** of selected pathophysiologic processes
- **Student Review Questions** for every chapter

Resources are also available online at thePoint.lww.com!

Instructor Resources

The instructor resource DVD available to accompany this text is a comprehensive resource including the following:

- **Test Generator** containing over 900 multiple-choice questions
- **PowerPoint** presentations with incorporated images from the book
- **Image Bank** featuring all of the figures from each chapter
- **Lecture Outlines** for presenting key information to your students
- **Assignments and Quizzes** for gauging student understanding
- **Discussion Topics** to encourage critical thinking
- **Case Studies** providing real life application of concepts
- **WebCT- and Blackboard-ready materials** for use with your institution’s Learning Management System.




Resources are also available online at thePoint.lww.com!

To the Reader

This book was written with the intent of making the subject of pathophysiology an exciting exploration that relates normal body functioning to the physiologic changes that occur as a result of disease, as well as the body’s remarkable ability to compensate for these changes. Indeed, it is these changes that represent many of the signs and symptoms of disease.

Using a book such as this can be simplified by taking time out to find what is in the book and how to locate information when it is needed. The *table of contents* at the beginning of the book provides an overall view of the organization and content of the book. The *index*, which appears at the end of the book, can be viewed as a road map for locating content. It can be used to quickly locate related content in different chapters of the book or to answer questions that come up in other courses.

Organization

The book is organized into units and chapters. The *units* identify broad areas of content, such as alterations in the circulatory system. Many of the units have *introductory chapters* that contain information about the normal structure and function of the body systems that are being discussed in the unit. These chapters, which are intended as a review of content from previous courses as well as an update on recent scientific advances in genetic and molecular biology, provide the foundation for understanding the pathophysiology content presented in the subsequent chapters. The *disorder chapters* focus on specific areas of pathophysiology content, such as heart failure and circulatory shock. The *chapter outline* that appears at the beginning of each chapter provides an overall view of the chapter content and organization. *Icons* identify specific content related to infants and children , pregnant women , and older adults .

Reading and Learning Aids

In an ever-expanding world of information you will not be able to read, let alone remember, everything that is in this book, or in any book, for that matter. With this in mind, we have developed a number of special features that will help you focus on and master the essential content for your current as well as future needs.

It is essential for any professional to use and understand the vocabulary of his or her profession. Throughout the text, you will encounter terms in *italics*. This is a signal that a word and the ideas associated with it are important to learn. In addition, in the back of the book are two aids that can be used to help you expand your vocabulary and improve your comprehension of what you are reading: the glossary and the list of prefixes and suffixes.

The *glossary* contains concise definitions of frequently encountered terms. If you are unsure of the meaning of a term you encounter in your reading, check the glossary in the back of the book before proceeding. The *list of prefixes and suffixes*, found in the inside back cover, is a tool to help you derive the meaning of words you may be unfamiliar with and increase your vocabulary. Many disciplines establish a vocabulary by affixing one or more letters to the beginning or end of a word or base to form a derivative word. Prefixes are added to the beginning of a word or base, and suffixes are added to the end. If you know the meanings of common prefixes and suffixes, you

can usually derive the meaning of a word, even if you have never encountered it before.

Boxes

Boxes are used throughout the text to summarize and highlight key information. You will frequently encounter two types of boxes: *Key Concept Boxes* and *Summary Boxes*. One of the ways to approach learning is to focus on the major ideas or concepts rather than trying to memorize significant amounts of information. As you have probably already discovered, it is impossible to memorize everything that is in a particular section or chapter of the book. Not only does your brain have a difficult time trying to figure out where to store all the different bits of information, your brain doesn't know how to retrieve the information when you need it. Most important of all, memorized lists of content can seldom, if ever, be applied directly to an actual clinical situation. The *Key Concept Boxes* guide you in identifying the major ideas or concepts that form the foundation for truly understanding the major areas of content. When you understand the concepts in the Key Concept Boxes, you will have a framework for remembering and using the facts given in the text.



Primary Immunodeficiency Disorders

- Primary immunodeficiency disorders are congenital or inherited abnormalities of immune function that render a person susceptible to diseases normally prevented by an intact immune system.
- Disorders of B-cell function impair the ability to produce antibodies and defend against microorganisms and toxins that circulate in body fluids (IgM and IgG) or enter the body through the mucosal surface of the respiratory or gastrointestinal tract (IgA). Persons with primary B-cell immunodeficiency are particularly prone to pyogenic infections due to encapsulated organisms.
- Disorders of T-cell function impair the ability to orchestrate the immune response (CD4⁺ helper T cells) and to protect against viral (CD8⁺ cytotoxic T cells), intracellular bacterial, fungal, and protozoan infections. T cells also play an important role in surveillance against oncogenic viruses and tumors; hence, persons with impaired T-cell function are at increased risk for certain types of cancers.
- Combined T-cell and B-cell immunodeficiency states affect all aspects of immune function. Severe combined immunodeficiency represents a life-threatening absence of immune function that requires bone marrow or stem cell transplantation for survival.

The *Summary Boxes* at the end of each section provide a review and a reinforcement of the main content that has been covered. Use the summaries to assure that you have covered and understand what you have read.

In summary, heart failure occurs when the heart fails to pump sufficient blood to meet the metabolic needs of body tissues. The physiology of heart failure reflects the interplay between a decrease in cardiac output that accompanies impaired function of the failing heart and the compensatory mechanisms that preserve the cardiac reserve. Compensatory mechanisms include the Frank-Starling mechanism, sympathetic nervous system activation, the renin-angiotensin-aldosterone mechanism, natriuretic peptides, endothelins, and myocardial hypertrophy and remodeling. In the failing heart, early decreases in cardiac function may go unnoticed because these compensatory mechanisms maintain the cardiac output. Unfortunately, the mechanisms were not intended for long-term use, and in severe and prolonged heart failure the compensatory mechanisms no longer are effective, and instead contribute to the progression of heart failure.

Tables and Charts

Tables and charts are designed to present complex information in a format that makes it more meaningful and easier to remember. Tables have two or more columns, and are often used for the purpose of comparing or contrasting information.

TABLE 8-2 Sources of Body Water Gains and Losses in the Adult

Gains		Losses	
Oral intake		Urine	1500 mL
As water	1000 mL	Insensible losses	
In food	1300 mL	Lungs	300 mL
Water of oxidation	200 mL	Skin	500 mL
		Feces	200 mL
Total	2500 mL	Total	2500 mL

Charts have one column and are used to summarize information.

CHART 18-1 Risk Factors for Atherosclerosis

Nonmodifiable

- Increasing age
- Male gender
- Genetic disorders of lipid metabolism
- Family history of premature coronary artery disease

Potentially Modifiable

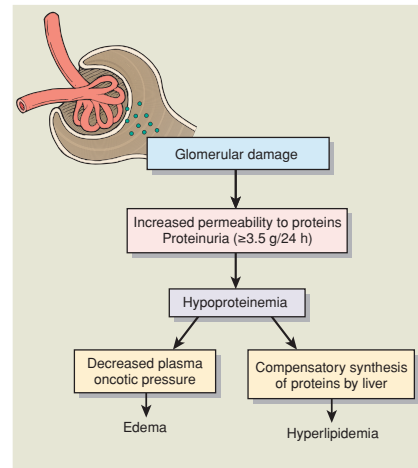
- Cigarette smoking
- Obesity
- Hypertension
- Hyperlipidemia with elevated low-density lipoprotein and low high-density lipoprotein cholesterol
- Diabetes mellitus

Additional Nontraditional

- Inflammation marked by elevated C-reactive protein levels
- Hyperhomocystinemia
- Increased lipoprotein (a) levels

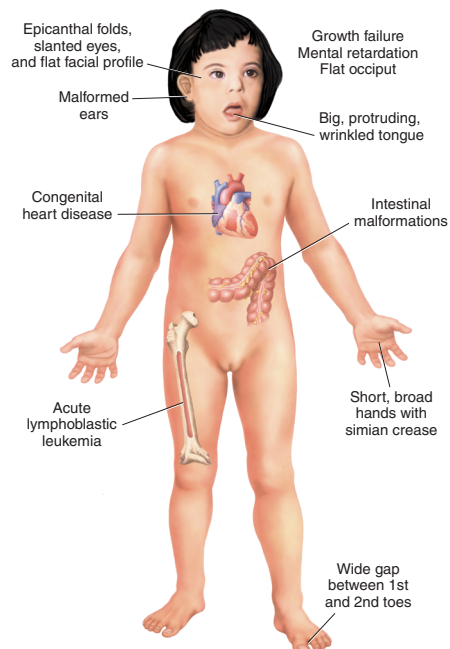
Illustrations and Photos

The full-color illustrations will help you to build your own mental image of the content that is being presented. Each drawing has been developed to fully support and build upon the ideas in the text. Some illustrations are used to help you picture the complex interactions of the multiple phenomena that are involved in the development of a particular disease; others can help you visualize normal function or understand the mechanisms whereby the disease processes exert their effects. In addition, photographs of pathologic processes and lesions provide a realistic view of selected pathologic processes and lesions.



Clinical Features

New to this edition is a new type of illustration that depicts the clinical features of persons with selected diseases. This feature is designed to help you visualize the entire spectrum of clinical manifestations that are associated with these disease states.



Understanding Physiologic Processes

Included in a number of chapters is an “*Understanding*” feature that focuses on the physiologic processes and phenomena that form the basis for understanding disorders presented in the text. This feature breaks a process or phenomenon down into its component parts and presents them in a sequential manner, providing an insight into the many opportunities for disease processes to disrupt the sequence.

Understanding Myocardial Blood Flow

Blood flow in the coronary vessels that supply the myocardium is influenced by (1) the aortic pressure, (2) autoregulatory mechanisms, and (3) compression of the intramural vessels by the contracting heart muscle.

1. Aortic Pressure. The two main coronary arteries that supply blood flow to the myocardium arise at the aortic valve. Because of the thickness of the vessel wall and the fact that the coronary arteries arise from the aorta when the aortic valve is open, the velocity of blood flow and majority of the flow occur during diastole, when the aortic valve is closed. Blood flow and the aortic pressure are transmitted directly into the coronary arteries.

2. Autoregulatory Mechanisms. The heart normally extracts 40% to 80% of the oxygen in the blood delivered to it, leaving little in reserve. Accordingly, oxygen delivery during periods of increased metabolic demand depends on autoregulatory mechanisms that regulate blood flow through a change in vessel tone and diameter. During increased activity, the arterial, constriction produces an increase in blood flow during decreased demand, vasodilation or return of vessel tone to normal produces a reduction in flow. The mechanism that fills the metabolic activity of the heart to change in vessel tone results from vasoactive mediators released from myocardial cells and the vascular endothelium.

3. Vessel Compression. The large coronary arteries lie on the epicardial surface of the heart, with the smaller intramural vessels branching off and arising through the myocardium. During systole, the contracting cardiac muscle has a squeezing effect on the intramural vessels while at the same time producing an increase in intramural pressure that pushes against and compresses the intramural vessels. In a steady blood flow in the intramural vessels is present during diastole. Because the time spent in diastole increases throughout the heart rate increase, intramural blood flow can be greatly reduced during sustained periods of tachycardia.

FIGURE 14.3. Autoregulatory mechanisms. Autoregulatory mechanisms include local pressure and flow changes and the release of vasoactive mediators. Autoregulatory mechanisms include local pressure and flow changes and the release of vasoactive mediators.

Material for Review

An important feature has been built into the text to help you verify your understanding of the material presented. After you have finished reading and studying the chapter, work on answering the *review exercises* at the end of the

chapter. They are designed to help you integrate, conceptualize, and apply material from the text. If you are unable to answer a question, reread the relevant section in the chapter.

REVIEW EXERCISES

1. A 6-year-old boy is admitted to the emergency department with nausea, vomiting, and abdominal pain. He is very lethargic; his skin is warm, dry, and flushed; his pulse is rapid; and he has a sweet smell to his breath. His parents relate that he has been very thirsty during the past several weeks, his appetite has been poor, and he has been urinating frequently. His initial plasma glucose is 420 mg/dL (23.1 mmol/L), and a urine test for ketones is strongly positive.
 - A. What is the most likely cause of this boy's elevated blood glucose and ketonuria?
 - B. Explain his presenting signs and symptoms in terms of the elevated blood glucose and metabolic acidosis.
 - C. What type of treatment will this boy require?

Appendix

The *Lab Values table* in the appendix of your book provides rapid access to normal values for many laboratory tests in conventional and SI units, as well as a description of the prefixes, symbols, and factors (e.g., micro, μ , 10^{-6}) used for describing these values. Knowledge of normal values can help you put abnormal values in context.

We hope that this guide has given you a clear picture of how to use this book. Good luck and enjoy the journey!