The guiding philosophy for this textbook was to create a rich resource that makes it as easy as possible for students to learn the fundamentals of human physiology while also providing a solid, comprehensive, and current overview of the field. It is our belief that a physiology textbook should emphasize deeper understanding of concepts over mere memorization of facts, in concert with useful tools for students with varying levels of preparation in biology, chemistry, physics, and related sciences, to aid them in their individual studies.

In developing the sixth edition, we’ve made several ambitious enhancements with these goals in mind, while retaining the book’s proven and trusted hallmarks: a direct and precise writing style; a clear and illuminating art program designed to maximize student learning; and pedagogical features that stimulate users’ interest, help readers think about physiological processes in an integrated way, and reinforce the most important concepts.

The most wide-ranging advancement in the sixth edition is the addition of more critical thinking activities in both the text and the online tool MasteringA&P®, the most effective and widely used online tutorial, homework, and assessment platform and system for the sciences. This online tool utilizes the most current resources, including chapter quizzes, self-paced tutorials, practice tests, guided animations, interactive physiological processes, expansive laboratory simulations, and the newly added Solve It case studies and Interpreting Data.

New to the Sixth Edition

In response to the feedback we received from users, reviewers, and instructors, we have made the following key enhancements to this edition.

- MasteringA&P®, an integrated text and technology learning system focusing on student comprehension and instructor adaptability, with reinforced clinical content, is included in this edition. Assignable, text-specific assets include online homework, tutorial, and assessment systems; self-paced tutorials; and customizable, assignable, and automatically graded assessments. MasteringA&P® icons and references appear at appropriate places throughout each chapter to direct students to related online resources.

- SOLVE IT, clinical case studies, appear in nine chapters. These cases are presented in the text but provide the option for the instructor or the student to go to the MasteringA&P® site to further analyze the case. One case continues through four chapters to further demonstrate systems integration; the other Solve Its are independent.

INTERPRETING DATA are new exercises provided in MasteringA&P®. These exercises are found in each chapter and focus on how to read graphs and tables using related data.

Chapter 1 Introduction to Physiology

INTERPRETING DATA: Obesity and Diabetes Mellitus Type 2. Students analyze a graph showing the relationship between BMI and risk for Type II Diabetes Mellitus, and comparing men to women.

Chapter 2 The Cell: Structure and Function

INTERPRETING DATA: The Genetic Code. Students will transcribe and translate a portion of DNA.

Chapter 3 Cell Metabolism

INTERPRETING DATA: Students will analyze data on the importance of one of the enzymes of glycolysis.

Chapter 4 Cell Membrane Transport

INTERPRETING DATA: Osmolarity and Osmosis. Students will be given the concentration of solutes in water and asked to determine osmolality and direction of water movement. There are four different scenarios, including the use of a hematocrit to determine if lysis of red blood cells has occurred.

SOLVE IT: How Can Membrane Transport Changes Lead to a Heart Attack?

Chapter 5 Chemical Messengers

INTERPRETING DATA: Receptor Antagonist Actions. Students compare graphs to determine if an antagonist had a significant effect on the actions of the messenger.

Chapter 6 The Endocrine System: Endocrine Glands and Hormone Actions

INTERPRETING DATA: Hormone Interactions. Students analyze graphs demonstrating antagonistic actions of two hormones and synergism between three hormones.
Chapter 7  Nerve Cells and Electrical Signaling
INTERPRETING DATA: Frequency of Action Potentials. Students analyze the typical trace of an action potential and refractory periods to determine the frequency of action potentials that could be generated.

Chapter 8  Synaptic Transmission and Neural Integration
INTERPRETING DATA: Quantal Release of Neurotransmitter. Students analyze data similar to that obtained by Katz to understand the concept of quantal release of neurotransmitters.

Chapter 9  The Nervous System: Central Nervous System

Chapter 10  The Nervous System: Sensor Systems
INTERPRETING DATA: Transduction in the Cochlea. Students analyze frequency response graphs of the basilar membrane.

Chapter 11  The Nervous System: Autonomic and Motor Systems
INTERPRETING DATA: Sympathetic and Parasympathetic Nerve Activity. Students compare graphs comparing the response of the autonomic nervous system to natural stimuli versus the effect of nerve stimulation on heart rate.
SOLVE IT: Why Does Mio Keep Falling Down? Part 4

Chapter 12  Muscle Physiology
INTERPRETING DATA: Variation in Percentage of Muscle Fiber Types. Students compare data of how different types of exercise affect the distribution of muscle fiber types.

Chapter 13  The Cardiovascular System: Cardiac Function
INTERPRETING DATA: Cardiovascular System. Students analyze how exercise and age affect cardiac efficiency.
SOLVE IT: Why Does Mio Keep Falling Down? Part 2

Chapter 14  The Cardiovascular System: Blood Vessels, Blood Flow, and Blood Pressure
INTERPRETING DATA: Blood Pressure and Velocity. Students compare graphs of blood pressure and blood velocity as blood moves through the systemic vasculature.
SOLVE IT: Why Does Mio Keep Falling Down? Part 1

Chapter 15  The Cardiovascular System: Blood
INTERPRETING DATA: Bleeding Time. Students analyze the effects of aspirin, acetaminophen, and warfarin on bleeding time compared to a placebo. Students also analyze the effects of von Willebrand’s Factor on bleeding time.
SOLVE IT: Why Is Marcus Forming Blood Clots and What Problems Can They Cause?

Chapter 16  The Respiratory System: Pulmonary Ventilation
INTERPRETING DATA: Effects of Smoke on the Bronchiole Epithelium. Students analyze data from a table to determine if nicotine had any effects on the bronchiole epithelium by comparing normal epithelial properties to that of epithelium exposed to nicotine.

Chapter 17  The Respiratory System: Gas Exchange and Regulation of Breathing
INTERPRETING DATA: Hemoglobin-Oxygen Saturation Curves. Students analyze the effects of temperature and pH on the hemoglobin-oxygen saturation curve. They then analyze the differences in maternal and fetal hemoglobin.

Chapter 18  The Urinary System: Renal Function
INTERPRETING DATA: Chronic Renal Disease. Students analyze the different causes of renal failure.

Chapter 19  The Urinary System: Fluid and Electrolyte Balance
INTERPRETING DATA: Water Gain and Loss in a Kangaroo Rat and a Human. Students analyze the differences in water balance that takes place in the kangaroo rat and a human.
SOLVE IT: Why Does Mio Keep Falling Down? Part 3
SOLVE IT: What is Causing Episodes of Muscle Weakness in this Patient?*
SOLVE IT: The Car Accident: How is Breathing Related to Acid-Base Balance?*

Chapter 20  The Gastrointestinal System
INTERPRETING DATA: Hormones Regulating Long-term Metabolism. Students analyze the effects of leptin and ghrelin over 24 hours with three meals.

Chapter 21  The Endocrine System: Regulation of Energy Metabolism and Growth
INTERPRETING DATA: The Stress Response. Students will compare actions of the autonomic nervous system and hormones on the body’s ability to tolerate stress.
SOLVE IT: How Are Insulin Pathways Involved in Diabetes Pathogenesis and Treatment?
Chapter 22  The Reproductive System

INTERPRETING DATA: Is it all because of hormones? Students will use a set of data comparing different aspects with a women and between men and women to determine how much the sex hormones affect appearance and behavior.

SOLVE IT: Does Sex Determination Have Only Two Possible Outcomes: Male or Female?*

Chapter 23  The Immune System

INTERPRETING DATA: AIDS-Related Deaths in the United States. Students study the pattern of AIDS-related deaths over the years.

Chapter 24  Diabetes Mellitus

INTERPRETING DATA: Ketoacidosis. Students study blood values in a chart that will help determine that a patient is suffering from ketoacidosis.

SOLVE IT: How Does Diabetes Pathogenesis Progress?

*These Solve It tutorials are not printed in the textbook, but are assignable in MasteringA&P.