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Respiratory Physiology: The Essentials, 7th edition. John B West MD PhD DSc. Philadelphia: Lippincott, Williams, & Wilkins. 2005. Soft cover, illustrated, 186 pages, $36.95.

This is the seventh edition of a book that West initiated in 1974 to accompany the physiology course taught in the first year at the University of California, San Diego, Medical School. The intended use continues to be as an introductory text for medical and allied health students, and it is widely used in this country and elsewhere (translated into 13 languages) as a primary or supplementary resource. It has been updated approximately every 5 years, but as the basic concepts discussed have been well established for 30–50 years or more, the changes are minor and would not warrant replacing an earlier edition. With such a long history it seems appropriate to begin by comparing this edition to its predecessors.

With the 6th edition the printing format changed to a thinner, glossier paper stock and red highlights were added to the formerly black-and-white chapter headings, titles, and figures. The glossier paper has enhanced some of the figures, and the photomicrographs are a bit sharper, but a concomitant reduction in line spacing and use of a slightly smaller, and notably less heavy, font gives an overall effect of distinctly reduced readability (maybe not an issue for the intended trainee audience, but a nuisance for this older reader). Compared to the 193 pages in the 5th edition on my bookshelf, the same content in the 6th edition needed only 171 pages. This has expanded to 186 pages in the current edition, occupying a softbound volume of similar size, but about two thirds the thickness of the earlier versions. The added pages do not reflect new content but do accommodate some reader-friendly additions. Chapters are now prefaced by a list of topics covered and an introductory overview. Boxed insets of bulleted review points are also new and likely to be helpful to the student, but the red-on-pink format is less successful. Study questions have been moved from an appendix in the back of the book to the end of each chapter, and changed from open-ended queries to standard multiple choice format.

The book begins appropriately with a review of structure as it applies to function, describing the gas-blood interface, the conducting airways and alveolar spaces, and the organization of vascular supply, with brief allusions to the efficiency of air and blood flow. Surface tension, surfactant, and particle removal are introduced, with reference to later chapters for more discussion.

Although many texts begin a discussion of respiratory physiology with lung and thoracic mechanics, West prefers to begin with gas exchange. This may reflect his long interest in this topic, but also, as he explains in the preface, the pattern of the first-year course at University of California, San Diego, where he finds the physical principles of pressure and flow to be daunting to the modern student. The chapter on ventilation does present the static lung volumes and the measurement of functional residual capacity via the helium-dilution method or body plethysmography (the latter as daunting as any aspect of mechanics to most students and trainees, in my experience), then focuses on the concept of alveolar ventilation and the measurement of anatomic and physiologic dead space. The usual very clear exposition is marred by a misleading statement: "Another way of measuring alveolar ventilation . . . is from the concentration of CO_2 in expired gas," followed by an equation including "$\%CO_2$" but only later noting that this is the alveolar, not expired, concentration and can be obtained from arterial measurement.

Chapter 3 discusses diffusion in some detail, including perfusion-limited versus diffusion-limited gases, and the partitioning of resistance to gas transfer into its components of membrane diffusion and chemical combination with hemoglobin. The single-breath method for measuring diffusing capacity is described only conceptually. CO_2 equilibration is given brief mention, but a figure from earlier editions, which helped to overcome the common misconception that CO_2 equilibrates much more rapidly than O_2, has been dropped. There are several references, in this chapter and elsewhere (eg, page 58), to expected changes "when the blood-gas barrier is thickened" that tend to reinforce the common idea that this is the major cause of a low diffusing capacity, whereas loss of alveolar-capillary surface area and capillary blood volume are more likely abnormalities.

The chapter on blood flow and metabolism describes pressure and flow relationships in the pulmonary circulation, including the behavior of alveolar versus extra-alveolar vessels and the responses to lung volume change. The discussion of blood-flow distribution elaborates the 3-zone model developed by West, based on the relationship of intravascular and extravascular pressure at the alveolar capillary level, which emphasizes gravitational effects on hydrostatic pressure and flow. Only very briefly acknowledged is a more recent body of evidence that shows considerable heterogeneity of flow within isogravitational planes, and modest redistribution with change of posture or gravitational direction, and which suggests an important role for anatomic variation in more proximal vessels. The important role of hypoxic vasoconstriction is well discussed, with updates in the current edition to new evidence on the chemical mechanism. The Starling law of fluid exchange is presented with estimates of values in the pulmonary circulation, with a brief consideration of lymph flow, and interstitial and alveolar edema.

The chapter on ventilation-perfusion relationships begins with a discussion of alveolar ventilation of the lung as a whole, introduces the alveolar gas equation, then elaborates on 4 causes of hypoxemia: hypoventilation, diffusion, shunt, and ventilation-perfusion inequality. The discussions of shunt and ventilation-perfusion make somewhat awkward forward referral to the following chapter, which presents the hemoglobin-oxygen dissociation curve. Reflecting the author's special interest in this area, this chapter goes into greater depth than others, presenting a detailed analysis of regional gas exchange, from the top to bottom of the lung, and introducing ventilation-perfusion ratio distributions from the multiple inert gas research technique. The effect of ventilation-perfusion inequality on CO_2 exchange, which is often overlooked or oversimplified in introductory texts, is well described here.

Chapter 6 deals with gas transport by the blood, beginning with the shape and behavior of the oxygen-dissociation curve, and comments on carbon monoxide and methemoglobin. The components of CO_2 and HCO_3^- storage and exchange are explained. This chapter also includes a brief discussion of the acid-base status of the blood. The

Henderson-Hasselbach equation is fully derived, which is something of an exception in this book; most of the physiologic equations elsewhere are simply presented in final form. The 4 primary acid-base disturbances and their compensations are described with reference to the Davenport diagram. Blood-tissue gas exchange is addressed, with consideration of capillary density, tissue diffusion, and critical P_{O_2} at the mitochondrial level.

The chapter on mechanics of breathing begins with a brief description of the respiratory muscles; then the pressure-volume curve of the lung is presented, with hysteresis, and compliance is discussed. Students often have difficulty with positive and negative signs when dealing with lung-chest wall mechanics, and Figure 7.3 may add some confusion, because the pressure-volume curve is depicted with negative pleural pressure on the X axis, but the accompanying text states that "this axis also measures transpulmonary pressure," without making clear that the values would then be positive.

Surface tension and surfactant receive detailed attention. The previously described difference in ventilation from top to bottom of the lung and basilar airway closure at low lung volume are well explained with graphic presentations of the vertical gradient of pleural pressure and relative position on the lung pressure-volume curve. The interaction with the chest wall is introduced with the classic 3-component pressure-volume curve. The topic of airway resistance and dynamic compression during forced expiratory flow extends to presentation of isovolume pressure-flow curves that may be beyond introductory readers.

Chapter 8 gives a basic presentation of ventilatory control, including neural aspects, chemoreceptors, and responses to CO_2 and hypoxia. This is followed by a chapter titled "Respiratory System Under Stress," which includes a potpourri of topics, many not typically encountered in a text of this type. Exercise physiology, but not clinical exercise testing, is briefly discussed, followed by a section on high-altitude gas exchange, another long interest of Dr West. Other topics are oxygen toxicity, space flight, diving physiology, decompression sickness, effect of atmospheric pollutants, the concept of liquid breathing, and perinatal respiration from placenta to first breath.

The tenth and final chapter deals with tests of pulmonary function, but with an emphasis that seems ill-suited to the intended reader. After a very brief introduction to spirometry, the flow-volume curve, and measurement of functional residual capacity via nitrogen washout (helium dilution and plethysmography were included in Chapter 2), diffusion is passed over, and the author's interest is reflected in more detailed discussion of tests that reflect ventilation-perfusion relationships, such as the single-breath alveolar plateau, multi-breath nitrogen-washout profile, closing volume, frequency dependence of compliance, and construction of an O_2-CO_2 diagram.

The appendixes include a listing of symbols and equations used in the text (some in more detail), answers to the study questions, and suggestions for further reading. For each chapter 5–7 classic papers, reviews, or books by the pioneers and luminaries of respiratory physiology are listed. Appropriately, most of these are not recent, but a few publications from the past 5 years are included. For more experienced readers who want to better understand the foundation of their specialty, this citation list may be the most valuable component of the book. Finally, a detailed subject index is provided to guide the reader to areas of interest.

In a volume polished over many iterations, one would expect only rare errors, and that is true here. On page 39 a reference that should be to Figure 1.6 in an earlier chapter, has been to Figure 1.3 in at least the last 3 editions. On page 63, the denominator term is missing from the ventilation-perfusion equation, which is correctly shown in the appendix.

West's **Respiratory Physiology: The Essentials** has stood the test of time and will continue to introduce medical, nursing, and respiratory-therapy trainees to the physiologic concepts and relationships that underlie respiratory care practice. It can also serve as a useful guide for those who wish to refresh that knowledge. The focus is normal physiology, with only a few allusions to pathologic alterations, so students in respiratory system courses that encompass both normal function and disease processes of the lungs will need additional resources. West has also produced a companion volume, *Pulmonary Pathophysiology: The Essentials*, now in its 6th edition.

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Respiratory Physiology: A Clinical Approach. Richard M Schwartzstein MD and Michael J Parker MD. *Integrated Physiology* series. Baltimore: Lippincott, Williams, & Wilkins/Wolters Kluwer. 2006. Soft cover, illustrated, 232 pages, with CD-ROM, $37.95.

In the preface the authors state that they have organized the contents of this book to emphasize that breathing depends on more than the lungs; this approach is necessary for understanding the clinical problems that result from malfunctions of the respiratory system. The emphasis is on what the clinical student needs to know (or review) to deal with a patient's problem on hand, although this book is a physiology—not pathophysiology—text. The authors have indeed succeeded admirably in their goals. This book would be appropriate for any student of physiology, but especially those interested in clinical problems.

Chapter 1, "Getting Started: the Approach to Respiratory Physiology," gives an overview of the integrated approach. The authors divide the system into the respiratory controller, the ventilatory pump, and the gas exchanger. This chapter also introduces the book's accompanying CD-ROM, which contains animations and simulations. Material covered in the CD-ROM is marked in the book with a "film" icon, which makes the CD-ROM material easy to find. Each chapter starts with a clear outline, followed by an extensive list of learning objectives. The book's sections are well marked by headers, the level of which is easily discerned because of the judicious use of fonts and color. Where appropriate, "Quick Check" lists summarize major points. Figures and tables are well-placed, well-designed, and clearly marked. "Thought Questions" are interspersed in the text and give the reader a chance to see whether the material just covered is appreciated well enough to integrate into an overall understanding; some of these questions are clinical in nature.

Four sections complete each chapter: the "Putting It Together" sections give clinical vignettes, followed by physiologic explanations. The "Summary Points" are bulleted lists of the major concepts covered in the section. Then a section provides the answers to the "Thought Questions." Concluding each chapter is a section of review questions, the answers to which are at the end of the book. The strength of this approach is