attempting to read the text from a student's point of view, I thought that the introductory chapter and the chapter on structural anatomy presented many concepts too simply, leaving unanswered questions and potential misunderstandings. On the other hand, the chapters on respiratory system physiology and physics were well written.

Several of the references are more than 10 years old. A few such old references are acceptable for concepts and structural images that do not change, but the chapters on physiology and procedures should provide more up-to-date references. For example, the most recent reference in the chapter on pulmonary function testing was from 1987. The index is comprehensive and appropriate as a resource for the intended audience.

The Respiratory System demonstrates the authors' dedication and efforts toward integrating clinical situations into the didactic setting, using a nonintimidating approach. As a supplemental resource to core texts used in training allied health professionals, this book broadens the spectrum of available information on foundational concepts about the respiratory system. However, compared to standard texts used for the education of respiratory therapy students, it does not provide the depth of knowledge that would allow it to stand alone as a core text on the respiratory system.

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Mechanics of Breathing: Pathophysiology, Diagnosis, and Treatment. Andrea Aliverti, Vito Brusaco, Peter T Macklem, and Antonio Pedotti, editors. Milan, Italy: Springer-Verlag. 2002. Hard cover, illustrated, 371 pages, $99.

The articles in this symposium volume are based on a series of lectures delivered as part of a post-graduate course entitled "What is new in mechanics of breathing: implications for diagnosis and treatment," which was held in Como, Italy, in 2001. The 57 investigators and clinicians who contributed the 31 chapters are from 10 countries, and all 4 of the symposium editors have distinguished international reputations in respiratory physiology.

The book's foreword states the premise that advances in our understanding of the mechanics of the chest wall and lungs will yield new insights into the pathophysiology, diagnosis, and treatment of pulmonary disease. The text is in 4 sections, which are on physiology (4 chapters), assessment of respiratory function (10 chapters), pathophysiology of airway function (9 chapters), and assisted ventilation and intensive care (8 chapters).

The physiology section begins with a chapter that provides a fairly quantitative and highly integrated treatment of the mechanics of normal ventilation at rest and during exercise. The emphasis is on the extremely complex interactions among the various ventilatory muscle groups and the chest wall. The second chapter examines the metabolic and mechanical costs of meeting the ventilatory requirements of exercise in normal subjects and then addresses exercise-induced respiratory muscle fatigue and how that fatigue affects exercise performance, including a fairly sophisticated analysis of muscle sympathetic nerve activity's affect on skeletal muscle blood flow during heavy exercise. The question of whether respiratory muscle training might enhance exercise performance is also briefly addressed.

The last 2 chapters of the first section examine mechanics at the level of the airway. Chapter 3 focuses on interrelationships among pressure, flow, and volume in the normal and asthmatic lung and describes in great detail the behavior of bronchiolar smooth muscle, particularly during deep inflation maneuvers. Chapter 4 describes the molecular and cellular mechanisms underlying the mechanical characteristics of airway smooth muscle, again with particular emphasis on events during deep inflation, in both asthmatics and nonasthmatics.

The second section, on assessment of respiratory function, reviews a potpourri of high-tech, noninvasive and minimally invasive approaches to characterize pulmonary function. A unifying theme in this section is the development of techniques that can accurately characterize the heterogeneity of pulmonary disease. Chapter 5 describes opto-electronic plethysmography, which uses a strobe light (which flashes at frequencies up to 100/s) to optically map the changing conformation of chest and abdominal surfaces during various breathing maneuvers. This method is completely noninvasive and allows highly accurate and reproducible measurements of changes in abdominal and chest movements associated with breathing patterns for rest, exercise, sleep (and even singing!) with minimal disturbance to the subject. Chapter 6 describes the use of dynamic magnetic resonance imaging (MRI) for diagnosis and management of emphysema. The authors show the usefulness of MRI for identifying patients who would most benefit from lung-volume-reduction surgery.

Chapter 7 describes how acoustic reflection, a technique originally developed to search for deep oil deposits in geologic formations, has been adapted to image the geometry of the upper airway. Acoustic reflection is also completely noninvasive; as with searching for oil, no drilling is required! which makes it particularly useful for examining the upper-airway structure of children and infants. The author also suggests potential applications for sleep apnea studies. Chapter 8 describes studies done with "Technigas" (an aerosol that contains technetium-radiolabeled carbon particles < 0.01 μm), the airway-distribution of which shows that expiratory flow limitation in the diseased lung is typically heterogeneous rather than homogeneous and that expiratory-flow-limitation measurements made at the mouth may not be the best way to monitor the severity of obstructive pulmonary disease.

Chapter 9 comprehensively reviews the current state of computed tomography (CT) technology, with particular reference to the spiral CT and the usefulness of combining a tomogram with simultaneous positron emission tomography, MRI, and perfusion scans. As these techniques are refined, they will allow increasingly precise description of lung function, particularly in early disease states. Chapter 10 describes the use of positron emission tomography alone to provide detailed images of regional perfusion, ventilation, shunt, gas trapping, and (with administration of appropriate intravenous reagents throughout the scan) physiological processes such as inflammation, vascular permeability, and changes in extravascular lung water. Chapter 11 reviews how gas washout and aerosol bolus techniques can be extended to evaluate the heterogeneous distribution of ventilatory gas flow and to identify the specific airway generations where the heterogeneity is most pronounced.

Chapters 12 and 13 discuss the forced oscillatory technique to measure respiratory system impedance (the integrated resistance to flow in a system in which flow is generated by an oscillating pressure gradient). These measurements in turn yield information about respiratory system mechanics.

Chapter 13 analyzes data from simultaneous measurements of respiratory system impedance and changes in chest and abdominal wall conformation determined with opto-electronic plethysmography. These techniques are in the early stages of development, and although the authors enthusiastically tout their ability to give insights into pulmonary system mechanics, the nature of those insights is not at all clear from Chapters 12 and 13.

Chapter 14 completes the section on assessment of respiratory function with an analysis of the one phenomenon universal to all respiratory disease—dyspnea. Traditionally, dyspnea is defined as "air hunger" or the sensation of difficult and/or painful breathing, and respiratory therapists tend to characterize all dyspnea as pretty much the same. This chapter reviews evidence that dyspnea arises from complex interactions between the central nervous system and various sensory components within the lung and chest wall. Dyspnea can arise from various sources (muscle weakness and fatigue, hypercapnia, and sensory input from upper-airway receptors and respiratory-muscle proprioceptors), and different types of dyspnea can be distinguished and related to pulmonary pathology (eg, a sense of "chest constriction" in asthma, a sense of "breathlessness" in interstitial lung disease, and a sense of "air hunger" in patients with hypercapnia). This chapter seems rather awkwardly placed, because it does not focus on any specific technology for measuring pulmonary function. In my opinion, it would have fit better in the third section of the volume.

The third section reviews the pathophysiology of airway obstruction (chronic obstructive pulmonary disease [COPD] and asthma) from various perspectives. The inflammatory etiology of both COPD and asthma is thoroughly reviewed in Chapter 15, both at the level of the airway and the lung parenchyma. Chapter 16 focuses on airway remodeling as a consequence of inflammatory processes in both conditions. The emphasis in Chapter 17 is on the relationship between inspiratory capacity and exercise tolerance in COPD. These authors cite data that inspiratory capacity may be a more sensitive indicator of COPD severity than are flow-limitation measurements. In addition, inspiratory capacity may be more useful in evaluating COPD patients' response to bronchodilator therapy. In the words of the authors, "It is time for inspiratory capacity, the Cinderella of pulmonary function testing, to take pride of place with her 2 stepsisters, FEV_1 [forced expiratory volume in the first second] and FVC [forced vital capacity]" (page 207).

Chapter 18, on the other hand, focuses on flow limitation during exercise in COPD. Opto-electronic plethysmography during pulmonary function testing can discern at least 2 different physiological adaptive strategies for dealing with flow limitation during exercise in COPD patients. Further, it was discovered that changes in abdominal volume may be more important than changes in rib cage volume during exercise in COPD, and that pulmonary rehabilitation should include specific retraining of abdominal muscles, the diaphragm, and chest wall muscles. Chapter 19 also discusses pathophysiology in terms of flow limitation but emphasizes that a multipronged approach is necessary for successful COPD treatment. Successfully treating dyspnea may involve not only treating airway narrowing and hyperinflation but also decreasing central drive.

Chapter 20 discusses response to bronchodilators, noting that though patients frequently sense relief from bronchodilators, there is often little change in the indices used to evaluate the effectiveness of bronchodilators. However, the author describes evidence that the classical techniques used to measure FEV_1 and FVC, particularly the use of deep inspirations prior to the measurement, are inappropriate and suggests a different approach that yields more realistic results. Chapter 21 cites microscopic, in vitro, anatomical evidence about how the asthmatic airway is structurally different from that of the nonasthmatic. With high-resolution computed tomography the author's laboratory demonstrated in vivo both decreased airway caliber and decreased airway distensibility in asthmatics, which became more pronounced with greater asthma severity.

The last 2 chapters of this section present particularly unconventional and provocative ideas concerning airway smooth muscle behavior in asthma. Chapter 22 describes temporal variability in airway size in both normal and asthmatic subjects and suggests that the behavior of airway smooth muscle in asthmatics (increased shortening velocity) produces a thermodynamic instability that leads to the intermittent bouts of airway constriction characteristic of asthma attacks. Chapter 23 proposes the novel idea that airway hyperresponsiveness in asthma is due to decreased sensitivity of airway smooth muscle to nitric oxide and reviews evidence in support of that idea.

The last section, on assisted ventilation and intensive care, covers both conventional and unconventional techniques used to treat various respiratory pathologies. Various forms of noninvasive positive-pressure ventilation (NPPV) have come to be used more frequently in recent years. Chapter 24 reviews the use of continuous positive airway pressure, including its clinical indications and various delivery techniques such as intermittent hyperinflation maneuvers and the NPPV helmet (a transparent helmet that covers the entire head and seals at the neck). The NPPV helmet has the advantage that it does not produce pressure points on the face and it seems to cause less claustrophobia for patients. Chapter 25 reviews over 50 studies of NPPV for critically ill patients who in the past certainly would have been intubated.

Chapter 26, by far the longest in the book, is an exhaustive review of electrical stimulation of respiratory muscles for patients with spinal cord injuries. The chapter reviews studies of phrenic nerve stimulation to achieve inspiration, and stimulation of abdominal muscles to restore cough and a more normal pattern of distribution of inspired lung volume. Along with at least partial restoration of inspiratory function, phrenic nerve stimulation appears to have cardiovascular benefits, preventing or delaying the onset of cor pulmonale, which is frequently seen in spinal cord injury patients on long-term mechanical ventilation. Restoration of cough function improves spinal cord injury patients' ability to clear secretions and thus decreases morbidity and mortality due to infection. Also, stimulating abdominal muscles during expiration increases tidal volume and results in a more natural distribution of inspired gas throughout the lung.

Chapters 27, 28, and 29 are on monitoring ventilatory variables in severely ill, mechanically ventilated intensive care patients, to enhance the quality of ventilator management. Chapter 27 describes the use of opto-electronic plethysmography with mechanically ventilated patients, which allows tracking of volume changes in different chest compartments, continuous monitoring of end-expiratory lung volumes, construction of more realistic static pressure-volume curves, and more accurate assessment of patient-ventilator interactions. Chapter 28 discusses how continuously monitoring re-

sistance, elastance, and intrinsic positive end-expiratory pressure with a microprocessor-controlled ventilator improves ventilator management of the most critically ill patients. However, the authors point out that, although the newest ventilators can make those measurements, the algorithms those machines use are not up to date. For example, they show data suggesting that intrinsic positive end-expiratory pressure is nearly always underestimated and that elastance is nearly always overestimated by the algorithms in the newest ventilators. They suggest continuously recording basic measurements from the ventilator into an online system that makes the calculations with more accurate algorithms. Chapter 29 describes how the forced oscillation technique can measure respiratory mechanics. The forced oscillation technique has the advantage that it can be used with patients undergoing either invasive ventilation or NPPV without interrupting the ventilatory cycle.

The last 2 chapters review treatments for acute respiratory distress syndrome and acute lung injury (ARDS/ALI). Chapter 30 focuses on the "open lung" approach, which involves mechanical ventilation maneuvers that reopen atelectatic lung units and then prevent recurrent collapse, thereby preventing or at least minimizing ventilator-induced lung injury. Chapter 31 examines the evidence that favors prone positioning for ARDS/ALI patients.

This symposium volume covers an incredibly broad portion of the spectrum of pulmonary disease. Initially, it seems more a cacophony than a symphony; however, a careful examination of the range of topics reveals a number of overarching themes:

1. NPPV and minimally invasive techniques to measure pulmonary function are being developed. Opto-electronic plethysmography seems to hold particular promise.
2. Simultaneous use of several techniques (eg, CT, MRI, and opto-electronic plethysmography) has yielded astonishing new insights into the pathophysiology of pulmonary disease.
3. Data from several research fronts indicate that the impact of pulmonary disease is very heterogeneously distributed in the lungs, so the most successful evaluation and treatment techniques will take that into account.
4. Much of the abnormal behavior of the asthmatic airway can be explained by disturbances in the cycle of increasing/decreasing airway diameter that occur normally during the ventilatory cycle.
5. The most successful treatment strategies for severe pulmonary disease (especially ARDS/ALI) will use continuous, real-time monitoring of pulmonary mechanics to enable treatment tactics that respond immediately to changes in patient condition as the disease process evolves.

Although the articles in this symposium volume are for the most part clear and well written, they do demand from the reader a rather sophisticated background in respiratory physiology, respiratory physics, basic biology, and statistics. The book contains much useful and interesting information; however, its greatest assets are the many new and thought-provoking concepts presented.

Good editorial work on this volume resulted in a very similar structure to the articles throughout the book. The major concepts of each article can be quickly discerned from the first and last section of the article, and if the reader wishes to delve deeper, information is presented clearly and concisely, and concepts are well developed in the remainder of each article. Figures are clear and well drawn, and the figure legends are thorough. Color is used sparingly, but to great advantage.

The most glaring editorial weakness I found in the book was the foreword. Such a book should have its objectives clearly and unambiguously laid out at the beginning. Instead the foreword is awkwardly written and does not represent the book's contents particularly well. In my opinion it does not begin to do justice to the overall quality of the book or to the intriguing ideas presented.

This volume certainly should be included in the collection of any good medical library, but it is not a book that most respiratory therapists will need on their bookshelf. However, for anyone interested in research or even just exploring some of the newest concepts in pulmonary physiology and medicine, it would be a worthwhile read. In addition, anyone preparing advanced lectures, review articles, or textbooks on any respiratory care topic would be well advised to consult it.

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Manual of Pulmonary Function Testing, 8th edition. Gregg L Ruppel MEd RRT RPFT FAARC. St Louis: Mosby/Elsevier. 2003. Soft cover, illustrated, 523 pages, $44.95.

Manual of Pulmonary Function Testing by Gregg Ruppel, now in its eighth edition, is a detailed instruction book on pulmonary function testing (PFT) It is directed toward beginning and advanced respiratory/pulmonary students, but I believe it is also a great reference tool for a PFT department or primary care clinic that performs PFT. This edition describes many of the PFTs, coaching techniques, and interpretation strategies. The first 6 chapters describe indications for pulmonary testing, coaching techniques, quality control issues while testing, and interpretation of the results. Some of the tests discussed are spirometry, lung volumes, diffusion capacity, and blood gases.

In Chapter 7 Ruppel discusses cardiopulmonary exercise testing, including the appropriate protocols, equipment, and interpretation of flow-volume loops. New to this edition is a chapter on pediatric and infant pulmonary testing. Chapter 9 deals with specialized testing regimens such as those used for bronchial provocation (methacholine challenge, histamine challenge, exercise challenge), pre-operative testing, disability testing, and indirect calorimetry. Chapter 10 talks about the various types of testing equipment and includes information on some of the newer portable spirometers designed for use in primary care practices. Chapter 12 discusses quality control in the PFT laboratory.

Chapter 1 provides an overview of indications for PFT and serves as an introduction to the subsequent chapters. Diseases are introduced that commonly require PFT and the pathologies associated with the various pulmonary disorders. The chapter also explains patient preparation for PFT.

Chapter 2 discusses spirometry—the most commonly performed PFT. Spirometry coaching techniques and reproducibility criteria are given. The chapter also discusses the differences between obstructive and restrictive disorders, and case studies are used to illustrate those differences.

Chapter 3 discusses the various ways of measuring total lung capacity. To measure total lung capacity you must first measure the functional residual capacity, using either the closed-circuit method, open-circuit