

Respiratory Care

Principles and Practice

THIRD EDITION

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Brief Contents

SECTION I Respiratory Assessment 1

- Chapter 1** History and Physical Examination 2
- Chapter 2** Respiratory Monitoring 22
- Chapter 3** Hemodynamic Monitoring 42
- Chapter 4** Arterial Blood Gas Sampling, Analysis, and Interpretation 56
- Chapter 5** Blood Chemistries and Hematology 86
- Chapter 6** Cardiac Assessment 102
- Chapter 7** Imaging the Thorax 126
- Chapter 8** Pulmonary Function Testing 144
- Chapter 9** Interventional Pulmonary Procedures 171
- Chapter 10** Polysomnography 204
- Chapter 11** Nutrition Assessment and Support 216
- Chapter 12** Cardiopulmonary Exercise Assessment 231

SECTION II Respiratory Therapeutics 243

- Chapter 13** Therapeutic Gases: Manufacture, Storage, and Delivery 244
- Chapter 14** Therapeutic Gases: Management and Administration 273
- Chapter 15** Humidity and Aerosol Therapy 307
- Chapter 16** Airway Clearance and Lung Expansion Therapy 352
- Chapter 17** Airway Management 380
- Chapter 18** Cardiopulmonary Resuscitation 431

- Chapter 19** Mechanical Ventilators: Classification and Principles of Operation 462
- Chapter 20** Mechanical Ventilation 493
- Chapter 21** Noninvasive Ventilation and Continuous Positive Airway Pressure 532
- Chapter 22** Neonatal and Pediatric Respiratory Care 554
- Chapter 23** Extracorporeal Life Support for Respiratory Failure 581
- Chapter 24** Pulmonary Rehabilitation 594
- Chapter 25** Home Respiratory Care 606
- Chapter 26** Disaster Management 640
- Chapter 27** Respiratory Care of the Elderly 651
- Chapter 28** Patient Safety 671

SECTION III Respiratory Diseases 689

- Chapter 29** Principles of Disease Management 690
- Chapter 30** Patient Education 707
- Chapter 31** Infection Control Principles 747
- Chapter 32** Asthma 766
- Chapter 33** Chronic Obstructive Pulmonary Disease 801
- Chapter 34** Interstitial Lung Disease 831
- Chapter 35** Pulmonary Vascular Disease 845
- Chapter 36** Pneumonia 858
- Chapter 37** Cystic Fibrosis 890
- Chapter 38** Acute Respiratory Distress Syndrome 910
- Chapter 39** Postoperative Respiratory Care 921
- Chapter 40** Cardiac Failure 936
- Chapter 41** Trauma 961
- Chapter 42** Burn and Inhalation Injury 976
- Chapter 43** Neuromuscular Dysfunction 993
- Chapter 44** Sleep-Disordered Breathing 1033
- Chapter 45** Lung Cancer 1053
- Chapter 46** Neonatal and Pediatric Respiratory Disorders 1073

SECTION IV Applied Sciences for Respiratory Care 1113

- Chapter 47** Respiratory Anatomy 1114
- Chapter 48** Ventilation and Oxygenation 1131
- Chapter 49** Respiratory Mechanics 1148
- Chapter 50** Control of Breathing 1169
- Chapter 51** Cardiovascular, Renal, and Neural Anatomy and Physiology 1182
- Chapter 52** Physical Principles 1204
- Chapter 53** Chemistry for Respiratory Care 1222
- Chapter 54** Respiratory Microbiology 1249
- Chapter 55** Respiratory Drugs 1273

SECTION V The Respiratory Care Profession 1299

- Chapter 56** History of the Respiratory Care Profession 1300
- Chapter 57** Professional Organizations 1334
- Chapter 58** Ethics of Healthcare Delivery 1348
- Chapter 59** Healthcare Economics 1373
- Chapter 60** Respiratory Care Research and Evidence-Based Practice 1393

Contents

Preface **xvi**
Features **xviii**
About the Editors **xx**
Contributing Authors **xxii**
Reviewers **xxv**

SECTION I Respiratory Assessment 1

- Chapter 1** History and Physical Examination 2
Priscilla Simmons
Introduction 2
Creating a Therapeutic Climate 3
Components of the Health History 3
Vital Signs 4
Techniques of Assessment 5
Physical Examination of the Lungs and Thorax 6
Assessment of Other Body Systems 15
- Chapter 2** Respiratory Monitoring 22
Dean R. Hess
Introduction 22
Pulse Oximetry 23
Capnography 28
Transcutaneous Blood Gas Monitoring 35
Respiratory Rate and Pattern 37
Brain Tissue P_{O_2} 39
Near-Infrared Spectroscopy 40
- Chapter 3** Hemodynamic Monitoring 42
Dean R. Hess
Introduction 42
Cardiac Rate and Rhythm 42
Arterial Blood Pressure 43

Central Venous Pressure Monitoring 46
Pulmonary Artery Catheters 48
Clinical Use of Hemodynamic Measurements 53

- Chapter 4** Arterial Blood Gas Sampling, Analysis, and Interpretation 56
Shelley C. Mishoe
Introduction 56
Blood Gas Analyzers 57
Blood Gas Sampling 60
Quality Control and Proficiency Testing 67
Physiology of Acid–Base Balance 68
Acid–Base Disorders 77
Arterial Blood Gas Interpretation 78
- Chapter 5** Blood Chemistries and Hematology 86
Michal Senitko, Rajesh Bhagat, Neil R. MacIntyre
Introduction 86
Serum Electrolytes 87
Serum Chemistries Associated with Renal Function 93
Cardiac Enzymes and Proteins 94
Miscellaneous Serum Chemistries 95
Coagulation Tests 96
Hematology 97
Laboratory Standards and Quality Control 99
- Chapter 6** Cardiac Assessment 102
Jaspal Singh, William E. Downey
Introduction 102
Evaluation of Ventricular Function 102

- Valvular Function **105**
 Coronary Artery Disease **107**
 Arrhythmias **110**
 Refractory Hypoxemia **111**
- Chapter 7** **Imaging the Thorax 126**
Dean R. Hess
 Introduction **126**
 Density and Contrast **127**
 The Normal Chest Radiograph **127**
 Abnormalities Seen on Chest Radiographs **131**
 Cross-Sectional Imaging Techniques **137**
- Chapter 8** **Pulmonary Function Testing 144**
Jeffrey Haynes
 Introduction **144**
 Goals of Pulmonary Function Testing **145**
 Spirometry **145**
 Lung Volumes and Capacities **156**
 Specialized Pulmonary Function Tests **163**
- Chapter 9** **Interventional Pulmonary Procedures 171**
Ellen Volker, Amy Treece, Momen M. Wahidi, Scott L. Shofer
 Introduction **171**
 Diagnostic Bronchoscopy **171**
 Patient Selection **172**
 Patient Preparation **176**
 Flexible Fiberoptic Bronchoscopy Techniques **178**
 Complications of Bronchoscopy **186**
 Indications for Bronchoscopy **186**
 Therapeutic Bronchoscopy **190**
 Rigid Bronchoscopy **191**
 Airway Stenting **194**
 Pleural Disease **196**
 Future Directions **199**
- Chapter 10** **Polysomnography 204**
Bashir A. Chaudhary, Shelley C. Mishoe
 Introduction **204**
 Normal Sleep and Sleep Stages **204**
 Polysomnography Components **206**
 Scoring Criteria **210**
 Polysomnography Report **214**
- Chapter 11** **Nutrition Assessment and Support 216**
Mark S. Sioba
 Introduction **216**
 Effects of Nutrition on Respiratory Function and Critical Illness **216**
 Nutrition Assessment **218**
 Calculation and Measurement of Energy Requirements **220**
 Nutritional Support Guidelines **225**
- Chapter 12** **Cardiopulmonary Exercise Assessment 231**
Neil R. MacIntyre
 Introduction **231**
 Normal Cardiopulmonary Response to Exercise **231**
 Incremental Exercise Testing **233**
 Interpreting the Results of Incremental Cardiopulmonary Exercise Testing **236**
 Timed Walk Tests **237**
 Indications for Cardiopulmonary Exercise Testing **239**
 Safety Issues **240**
-
- SECTION II Respiratory Therapeutics 243**
-
- Chapter 13** **Therapeutic Gases: Manufacture, Storage, and Delivery 244**
John Boatright, Jeffrey J. Ward
 Introduction **244**
 Chemical and Physical Properties of Therapeutic Gases **245**
 Air **248**
 Oxygen **249**
 Manufacture and Distribution **251**
 Carbon Dioxide **252**
 Helium **253**
 Nitric Oxide **254**
 Nitrogen **255**
 Storage and Distribution of Medical Gases **255**
 Medical Gas Cylinders **255**

- Regulators **261**
 Safety-Indexed Connection Systems **262**
 Calculating Duration of Flow from a Gas Cylinder **264**
 Central Medical Gas Distribution **265**
 Central Compressed Medical Air Distribution **271**
- Chapter 14 Therapeutic Gases: Management and Administration 273**
John Boatright, Jeffrey J. Ward
 Introduction **273**
 The Rationale for Supplemental Oxygen **274**
 Indications for Oxygen Therapy **275**
 Limitations of Supplemental Oxygen **276**
 Complications and Hazards of Oxygen Therapy **277**
 Dosage Regulation and Administration Devices **280**
 Oxygen Administration Devices **283**
 Monitoring the Physiologic Effects of Oxygen **296**
 Clinical Application of Oxygen Therapy **297**
 Helium–Oxygen Therapy **300**
 Carbon Dioxide Therapy **302**
 Nitric Oxide Therapy **302**
- Chapter 15 Humidity and Aerosol Therapy 307**
Dean R. Hess
 Introduction **307**
 Humidity **307**
 Devices Used for Humidification **310**
 Bland Aerosol Therapy **316**
 Humidification to Tracheostomy **317**
 Device Selection for Humidity Therapy **317**
 Aerosol Drug Administration **318**
 Aerosol Generators **319**
 Aerosol Delivery During Invasive Mechanical Ventilation **340**
 Aerosol Delivery During Noninvasive Ventilation **343**
 Aerosol Delivery by Tracheostomy **344**
 Selection of an Aerosol Delivery Device **344**
 Aerosol Delivery for Systemic Disease **347**
- Chapter 16 Airway Clearance and Lung Expansion Therapy 352**
Dean R. Hess
 Introduction **352**
 Normal Mechanisms of Mucociliary Transport **352**
 Airway Clearance **355**
 Sputum Collection **370**
 Lung Expansion Therapy **371**
- Chapter 17 Airway Management 380**
John D. Davies, Alexander S. Niven, Dean R. Hess
 Introduction **380**
 Oropharyngeal Airways **380**
 Nasopharyngeal Airways **382**
 History of Intubation **385**
 Selection and Training of Personnel **385**
 Anatomy of the Upper Airway and Airway Assessment **386**
 Indications for Endotracheal Intubation **387**
 Initial Approach to Airway Management **388**
 Procedure of Endotracheal Intubation **393**
 The Difficult Airway: Assessment and Strategy **400**
 Extubation **406**
 Tracheostomy **408**
 Airway Cuff Concerns **420**
 Airway Clearance **423**
- Chapter 18 Cardiopulmonary Resuscitation 431**
Rhonda Bevis, Christine J. Moore, William F. Galvin
 Introduction **431**
 Cardiopulmonary Resuscitation **431**
 Basic Life Support **434**
 Advanced Cardiovascular Life Support **453**
 Ethical Concerns **458**
- Chapter 19 Mechanical Ventilators: Classification and Principles of Operation 462**
Robert L. Chatburn, Teresa A. Volsko
 Introduction **462**
 Basic Concepts **462**

- Understanding Ventilator Technology **470**
- Taxonomy of Mechanical Ventilation **483**
- Comparing Modes of Mechanical Ventilation **483**
- Chapter 20 Mechanical Ventilation 493**
Dean R. Hess, Neil R. MacIntyre
- Introduction **493**
- The Equation of Motion **495**
- Indications for Mechanical Ventilation **495**
- Complications of Mechanical Ventilation **496**
- Ventilator Settings **499**
- Monitoring the Mechanically Ventilated Patient **516**
- Choosing Ventilator Settings for Different Forms of Respiratory Failure **521**
- Ventilatory Support Involves Trade-Offs **523**
- Liberation from Mechanical Ventilation **523**
- Chapter 21 Noninvasive Ventilation and Continuous Positive Airway Pressure 532**
Dean R. Hess
- Introduction **532**
- Interfaces **532**
- Noninvasive Positive Pressure Ventilation **536**
- Continuous Positive Airway Pressure **543**
- Negative Pressure Ventilation, Rocking Beds, and Pneumobelts **549**
- Chapter 22 Neonatal and Pediatric Respiratory Care 554**
Melissa K. Brown
- Introduction **554**
- Neonatal Assessment **555**
- Oxygen Therapy **559**
- Mechanical Ventilation **560**
- Airway Management **562**
- Nasal Continuous Positive Airway Pressure **564**
- Noninvasive Positive Pressure Ventilation **566**
- Conventional Infant and Pediatric Ventilation **566**
- High-Frequency Ventilation **572**
- Adjuncts to Neonatal and Pediatric Mechanical Ventilation **578**
- Chapter 23 Extracorporeal Life Support for Respiratory Failure 581**
Kyle J. Rehder, David A. Turner
- Introduction **581**
- ECMO Basics **582**
- Indications and Contraindications **583**
- ECMO Utilization and Outcomes **584**
- Complications **586**
- Strategic Considerations **587**
- Technological Advancements **588**
- ECMO Transport **589**
- Expectations for the Coming Years **590**
- Chapter 24 Pulmonary Rehabilitation 594**
Neil R. MacIntyre, Rebecca Crouch
- Introduction **594**
- Mechanisms of Functional Deterioration in Patients with Chronic Lung Disease **595**
- Program Structure **596**
- The Process of Pulmonary Rehabilitation **596**
- Outcomes from a Pulmonary Rehabilitation Program **601**
- Reimbursement Issues **602**
- Future Directions **603**
- Chapter 25 Home Respiratory Care 606**
Angela King, Robert McCoy
- Introduction **606**
- Home Care Services **606**
- Goals of Home Care **607**
- The Medicare Program **607**
- The Respiratory Therapist as Home Care Provider **611**
- The Initial Home Visit **612**
- Bag Technique **613**
- Home Environment Evaluation **613**
- Long-Term Oxygen Therapy **617**
- Newer Home Therapies **626**
- Home Mechanical Ventilation **627**
- Evolution of Positive Pressure Home Mechanical Ventilators **631**

**Chapter 26 Disaster Management 640***Richard D. Branson, Dario Rodriquez Jr.*Introduction **640**History **640**The Threat **641**Planning for Mass Casualty Respiratory Failure **642**Ventilator Performance Characteristics **645**Ventilators for Mass Casualty Respiratory Failure **645**Triage **648****Chapter 27 Respiratory Care of the Elderly 651***William F. Galvin, Helen M. Sorenson*Introduction **651**The Demography of Aging **652**Terms Associated with Aging **654**Aging Pulmonary Anatomy and Physiology **655**Geriatric Patient Assessment **656**Atypical Disease Presentation **658**Geriatric Pharmacotherapy **660**Communicating with Older Adults **662**Pulmonary Disease After Age 65 Years **663**Role of the RT in Caring for the Elderly **668****Chapter 28 Patient Safety 671***Thomas Malinowski*Introduction **671**Patient Safety **672**Safety Initiatives and Respiratory Care Applications **675**Management of Medical Information **681**

SECTION III Respiratory Diseases 689

Chapter 29 Principles of Disease Management 690*William F. Galvin*Introduction **690**Trends and Directions in Healthcare Delivery **691**Terms and Concepts Associated with Disease Management **691**Forces Driving Disease Management **693**History and Evolution of Disease Management **696**Goals of Disease Management **698**Basic Principles of Disease Management **698**Diseases Targeted for Disease Management Programs **700**Development and Implementation of a Disease Management Program **700**The Future of Disease Management **704**Respiratory Therapists as Disease Managers **704****Chapter 30 Patient Education 707***William F. Galvin*Introduction **707**The Rationale for Patient Education **708**Terms Associated with Patient Education **709**Critical Role of Communication in Patient Education **712**Teaching and Learning Aspects of Patient Education **718**Goals in Patient Education **718**Process of Patient Education **719**Examples of Patient Education Programs **735****Chapter 31 Infection Control Principles 747***Donna D. Gardner*Introduction **747**Transmission of Infection **748**Strategies for Infection Control **749**Regulatory Agencies **749**Cleaning, Disinfection, and Sterilization **750**Precautions **756**Healthcare-Associated Infections Related to Respiratory Care Equipment **763****Chapter 32 Asthma 766***Timothy R. Myers, Timothy Op't Holt*Introduction **766**Epidemiology **767**Pathophysiology **769**

- Pathogenesis **771**
- Risk Factors **771**
- Asthma Phenotypes **771**
- Disease Severity Classification **775**
- Objective Measurements **782**
- Pharmacologic Therapy **786**
- Aerosol Therapy **791**
- Adjunctive Treatments **793**
- Education **795**
- Case Studies **796**

- Chapter 33** **Chronic Obstructive Pulmonary Disease** **801**
Puja Kohli
- Introduction **801**
- Burden of Chronic Obstructive Pulmonary Disease **801**
- Definitions and Staging of Disease **802**
- Etiology of Chronic Obstructive Pulmonary Disease **805**
- Pathophysiology of Chronic Obstructive Pulmonary Disease **806**
- Diagnosis and Clinical Course **809**
- Outpatient Care of Stable Chronic Obstructive Pulmonary Disease **809**
- Surgery **816**
- Overview of Management of Stable Chronic Obstructive Pulmonary Disease **819**
- Managing Exacerbations **819**
- Palliative and End-of-Life Care **825**
- Case Studies **825**

- Chapter 34** **Interstitial Lung Disease** **831**
Kathy A. Short, Andrew J. Ghio
- Introduction **831**
- Pathophysiology **831**
- Classification **833**
- Clinical Presentation and Diagnostic Evaluation **833**
- Pathology **838**
- Prognosis **838**
- Management **839**
- Specific Interstitial Lung Diseases **840**

- Chapter 35** **Pulmonary Vascular Disease** **845**
Charles William Hargett
- Introduction **845**
- Pathophysiology **845**
- Epidemiology **847**
- Diagnosis **848**
- Management of Selected Pulmonary Vascular Diseases **852**
- Case Studies **854**

- Chapter 36** **Pneumonia** **858**
Nicholas Wysham, Morgan Mullaney, Bryan D. Kraft
- Introduction **858**
- Definition and Classification of Pneumonia **859**
- Community-Acquired Pneumonia **859**
- Aspiration and Anaerobic Pneumonia **866**
- Nosocomial Pneumonia **867**
- Ventilator-Associated Pneumonia **868**
- Viral Pneumonia **873**
- Mycobacterial Pneumonia **875**
- Fungal Pneumonia **876**
- Pneumonia in Immunocompromised Patients **879**
- Pneumonia and HIV/AIDS **880**
- Pneumonia in Children **882**
- Case Studies **884**

- Chapter 37** **Cystic Fibrosis** **890**
Teresa A. Volsko, Catherine O'Malley, Bruce K. Rubin
- Introduction **890**
- History **890**
- Pathogenesis **891**
- Diagnosis **893**
- Extrapulmonary Manifestations **895**
- Respiratory Manifestations **897**
- Major Respiratory Complications **900**
- Standard Therapy of Lung Disease **902**

- Chapter 38** **Acute Respiratory Distress Syndrome** **910**
Craig R. Rackley, Christopher E. Cox, Michael A. Gentile
- Introduction **910**
- Definition **910**
- Incidence **911**
- Etiology **912**
- Clinical Manifestations **912**
- Pathobiology **913**
- Management **913**
- Outcomes **918**

Chapter 39 Postoperative Respiratory Care 921

Mark Simmons, Priscilla Simmons

- Introduction **921**
- Preoperative Assessment and Management **922**
- Preoperative Testing **925**
- Intraoperative Risk Factors **926**
- Postoperative Respiratory Failure: Assessment and Management **927**
- Atelectasis **929**
- Pulmonary Emboli and Pulmonary Thromboembolic Disease **930**
- Pneumonia **931**
- Mechanical Ventilation for Respiratory Failure **933**

Chapter 40 Cardiac Failure 936

*John C. Williams,
William S. Stigler* **936**

- Introduction **936**
- Definition **936**
- Cardiac Physiology **937**
- Determinants of Ventricular Function **938**
- Pathophysiology of Cardiac Failure **940**
- Pathophysiology of Pulmonary Edema **944**
- Heart–Lung Interactions **945**
- Clinical Aspects of Cardiac Failure **947**
- Measurement and Monitoring of Cardiac Function **949**
- Treatment Guidelines for Chronic Cardiac Failure **951**
- Treatment Guidelines for Acute Cardiac Failure **953**
- Acute Myocardial Infarction **954**
- Ventilatory Support of the Patient with Cardiac Failure **954**
- Case Studies **956**

Chapter 41 Trauma 961

*Bryce R. H. Robinson,
Richard D. Branson*

- Introduction **961**
- The Primary and Secondary Surveys **961**
- Thoracic Trauma **962**
- Airway and Breathing Injuries **962**
- Circulation Injuries **963**

- Injuries Encountered During the Secondary Survey **966**
- Head Trauma **969**
- Primary Survey Issues of Head Injury **972**
- Secondary Survey Issues of Head Injury **973**
- Treatment of Head Injuries **973**

Chapter 42 Burn and Inhalation Injury 976

Daniel F. Fisher

- Introduction **976**
- Burn Injury **976**
- Inhalation Injury **980**
- Management of Inhalation Injury **984**
- Case Studies **990**

Chapter 43 Neuromuscular Dysfunction 993

*Francis C. Cordova, John Mullarkey,
Gerard J. Criner*

- Introduction **993**
- Overview **994**
- Pathophysiology of Neuromuscular Disease on Respiratory Function **994**
- Evaluation of Respiratory Function in Patients with Neuromuscular Disease **1000**
- Assessment of Respiratory Muscle Function **1002**
- Upper Motor Neuron Disorders **1004**
- Lower Motor Neuron Disorders **1008**
- Disorders of the Peripheral Nerves **1010**
- Disorders of the Neuromuscular Junction **1015**
- Inherited Myopathies **1018**
- Acquired Inflammatory Myopathies **1023**
- Treatment of Neuromuscular Dysfunction **1023**

Chapter 44 Sleep-Disordered Breathing 1033

*Bashir A. Chaudhary, Arthur Taft,
Shelley C. Mishoe*

- Introduction **1033**
- Descriptions and Common Terms **1034**

Screening for Sleep-Disordered Breathing **1037**
 Obstructive Sleep Apnea **1038**
 Central Sleep Apnea **1047**
 Restless Legs Syndrome **1049**

Chapter 45 Lung Cancer 1053
Laura Brenner, Maha Farhat
 Introduction **1053**
 Classification **1053**
 Epidemiology **1056**
 Risk Factors and Etiology **1056**
 Presentation **1058**
 Solitary Pulmonary Nodule **1060**
 Diagnosis **1062**
 Workup and Staging **1063**
 Treatment **1063**
 Prognosis **1067**
 Prevention **1068**
 Future Directions **1069**
 Case Studies **1069**

Chapter 46 Neonatal and Pediatric Respiratory Disorders 1073
Sherry L. Barnhart
 Introduction **1073**
 Apnea of Prematurity **1074**
 Respiratory Distress Syndrome **1075**
 Bronchopulmonary Dysplasia and Chronic Lung Disease **1079**
 Transient Tachypnea of the Newborn **1082**
 Pneumonia in the Neonate **1083**
 Meconium Aspiration Syndrome **1085**
 Persistent Pulmonary Hypertension of the Newborn **1088**
 Congenital Diaphragmatic Hernia **1091**
 Congenital Pulmonary Anomalies **1094**
 Air Leak Syndrome **1096**
 Retinopathy of Prematurity **1099**
 Bronchiolitis **1101**
 Laryngotracheobronchitis **1104**
 Epiglottitis **1106**

SECTION IV Applied Sciences for Respiratory Care **1113**

Chapter 47 Respiratory Anatomy 1114
William F. Galvin
 Introduction **1114**

Growth and Development of the Respiratory System **1115**
 Gross Anatomy of the Respiratory System **1118**
 Anatomy of the Thorax **1122**
 Microanatomy of the Respiratory System **1127**

Chapter 48 Ventilation and Oxygenation 1131
William C. Pruitt
 Introduction **1131**
 Ventilation **1132**
 Physiologic Mechanisms of Hypercapnia **1132**
 The Alveolar Gas Equation **1135**
 Diffusion **1136**
 Ventilation-Perfusion **1137**
 Assessment of Oxygenation **1138**
 Physiologic Mechanisms of Hypoxemia **1139**
 Oxygen Transport **1141**
 Tissue Hypoxia **1145**

Chapter 49 Respiratory Mechanics 1148
Dean R. Hess
 Introduction **1148**
 Airways Resistance **1149**
 Compliance **1151**
 Pleural Pressure Gradient **1152**
 The Chest Wall **1153**
 Respiratory Mechanics During Mechanical Ventilation **1155**

Chapter 50 Control of Breathing 1169
Shawna Strickland
 Introduction **1169**
 Control of Breathing **1170**
 Effects of Acid-Base Disorders **1175**
 High Altitude and Control of Breathing **1176**
 Hypoxic Drive **1178**
 Opioid Drugs and Respiratory Drive **1178**
 Abnormal Breathing Patterns **1179**
 Respiratory Drive and Exercise **1179**
 Assessing Respiratory Drive **1180**

Chapter 51 Cardiovascular, Renal, and Neural Anatomy and Physiology 1182

*Georgianna Sergakis, Crystal Dunlevy,
Sarah Varekojis*
Introduction **1183**
Cardiovascular Anatomy and
Physiology **1183**
Renal Anatomy and Physiology **1192**
Neural Anatomy and
Physiology **1196**

Chapter 52 Physical Principles 1204

Dean R. Hess
Introduction **1204**
Basic Physics **1204**
Gas Laws **1209**
Humidity, Water Vapor, and
Evaporation **1212**
Gases in Solution, Diffusion, and
Osmosis **1214**
Conversion of Gas Volumes **1215**
Conservation of Energy **1216**
Fluid Flow **1216**
Application of Physical Principles
to Measurement and
Physiology **1220**

Chapter 53 Chemistry for Respiratory Care 1222

*Carl F. Haas, Allan G. Andrews,
Andrew J. Weirauch*
Introduction **1223**
Basic Chemistry **1223**
Inorganic Molecules **1233**
Organic Molecules **1237**
Fluid Balance **1243**
Metabolic Pathways **1246**

Chapter 54 Respiratory Microbiology 1249

*Ruben D. Restrepo, Marcos I.
Restrepo*
Introduction **1249**
Bacteria **1249**
Common Bacteria Associated
with Respiratory Disease **1254**
Viruses **1260**
Fungi **1263**
Parasites **1264**
Common Respiratory
Infections **1265**
Sampling Methods **1266**
Microbiology Techniques **1268**
Antimicrobial Therapy **1269**
Antimicrobial Resistance **1269**

Chapter 55 Respiratory Drugs 1273

Christopher D. Lyman
Introduction **1273**
Pharmacokinetics, Pharmacodynamics,
and Drug Delivery **1273**
Systemic Corticosteroids **1276**
Inhaled Corticosteroids **1278**
Beta-Adrenoceptor Agonists **1280**
Anticholinergic Agents **1282**
Methylxanthines **1283**
Leukotriene Modifiers **1284**
Mast Cell Stabilizers **1285**
Anti-IgE Therapy **1286**
Antimicrobial Therapy Via
Nebulization **1286**
Secretion Modifiers **1288**
Neuromuscular Blocking
Agents **1289**
Sedatives **1291**
Agents for the Treatment of
Pulmonary Arterial
Hypertension **1294**

SECTION V The Respiratory Care Profession 1299

Chapter 56 History of the Respiratory Care Profession 1300

Jeffrey J. Ward
Introduction **1300**
Historical Events and Key Advances in
Medical-Related Sciences **1300**
Historical Events That Signaled
the Evolution of Respiratory
Care **1310**
Milestones in the Organizations Within
the Respiratory Care Profession:
Beginning Years **1321**
Respiratory Care's Continuing
Evolution: Contemporary and Future
Changes **1325**

Chapter 57 Professional Organizations 1334

Lynda T. Goodfellow
Introduction **1334**
American Association for Respiratory
Care **1335**
American Respiratory Care
Foundation **1338**
National Board for Respiratory
Care **1338**

Commission on Accreditation for
Respiratory Care **1340**

National Association for Medical
Direction of Respiratory
Care **1342**

American College of Chest
Physicians **1342**

American Thoracic Society **1343**

American Society of
Anesthesiologists **1343**

Society of Critical Care
Medicine **1344**

The Joint Commission **1344**

National Asthma Educator Certification
Board **1345**

Association of Asthma
Educators **1346**

American Academy of Sleep
Medicine **1346**

Board of Registered Polysomnographic
Technologists **1346**

Chapter 58 Ethics of Healthcare
Delivery **1348**
Douglas E. Masini
Introduction **1348**
Definition of Ethics **1349**
Foundations of Ethical Thinking **1349**
Ethical Versus Legal Behavior **1350**
Ethical Theories **1351**
Ethical Principles **1352**
Role of Professional Organizations in
Ethics **1362**
Ethics Committees **1364**
Case Studies **1365**

Chapter 59 Healthcare Economics **1373**
Garry W. Kauffman,
William F. Galvin

Introduction **1373**
Basic Healthcare Functions **1374**
Stakeholders in the U.S. Healthcare
System **1375**
The Respiratory Therapist's Role in
Balancing Cost and Care **1377**
Forces Influencing Healthcare
Costs **1377**
A Brief History and Overview of
Financing Health Care **1380**
The Era of Managed Care **1384**
Reimbursement Methodologies **1386**
The Future of Healthcare
Funding **1389**
Respiratory Therapist Documenting
and Demonstrating Value **1390**

Chapter 60 Respiratory Care Research
and Evidence-Based
Practice **1393**
Dean R. Hess
Introduction **1393**
Research Design **1394**
Statistical Issues **1397**
Study Types **1400**
What Is Evidence-Based Respiratory
Care? **1403**
Hierarchy of Evidence **1404**
Evidence for a Diagnostic Test **1404**
Evidence for a Therapy **1407**
Meta-Analysis **1409**
Finding the Evidence **1409**
Narrative Reviews and Systematic
Reviews **1412**
Clinical Practice Guidelines **1412**

Glossary **1415**

Index **1464**

Preface

It took 10 years between the first and second editions of *Respiratory Care: Principles and Practice*. The wait is much shorter for this, the *Third Edition*. This edition is, in essence, more of a continuation of a good thing rather than a completely new start. Ten years ago, some might have considered this text dead—but today it is alive and better than ever.

As in the *Second Edition*, patient assessment is covered at the beginning of the text, followed by respiratory therapeutics, respiratory diseases, applied sciences, and, finally, the professional aspects of respiratory care. The new edition offers us a welcome opportunity to build on the successes of the second edition. We have strived to hone this edition to address all of the topics important to contemporary practice in respiratory care. Recognizing the physiologic basis for respiratory care practice, we have added chapters specifically related to physiology; they complement the discussions of physiologic concepts already present in many of the chapters.

Use of extracorporeal membrane oxygenation (ECMO) has expanded considerably in recent years. Consequently, a new chapter dedicated to this topic has been added in the *Third Edition*.

The inclusion of new contributors to this edition has infused this text with new ideas and more thorough and contemporary coverage of many topics. No chapter has remained untouched; indeed, many have been substantially rewritten. This is a brand-new edition of an already solid text—not just the previous edition repackaged with a new cover. Many of the contributors are respiratory therapists, while others are physicians. This diversity underscores the close working relationship between therapists and physicians in everyday respiratory care practice. Many of the contributors are recognized leaders in the field.

All of the successful pedagogical features of the first and second editions of *Respiratory Care: Principles and Practice* have been retained in this edition. These features include the use of clinical practice guidelines, glossary terms, key points, and respiratory recaps. As with previous editions, the text is richly illustrated to enhance the learning experience. We have also added a new

feature in this edition: Stop and Think boxes. Our intent in including them is to sharpen students' critical thinking skills. The Stop and Think boxes pose questions that often do not have a clearly right or wrong answer; they should stimulate discussion among students and faculty. The questions are posed, but the answers are intentionally absent.

The respiratory therapist of the 21st century must be a technologist, a physiologist, and a clinician. He or she is expected to be a clinical leader, a role that includes having input into the development of multidisciplinary care plans and implementation of respiratory care protocols. Moreover, contemporary practice is evidence based. Each of these important tenets of modern respiratory care practice is carefully and deliberately incorporated into this text.

The primary audience for this text is respiratory therapy students. We have written this text for students while considering the examination matrix of the National Board for Respiratory Care (NBRC), to ensure that all of the topics on the board exams (and more) are included. Nevertheless, this volume is more than just a text designed to ensure success on the board exams. It includes many topics that go beyond the NBRC exam matrix and that are intended to help students become well-rounded members of the patient care team.

Our goal was to make this text readable and to put the content within reach of students. As part of this effort, we have included boxes, tables, and illustrations to assist learning. We have carefully edited the text for consistency in writing style throughout, but we have not diluted the content. The material may be challenging in some places, but the intent was not to make it difficult. Rather, we seek to help students maximize their contributions when interacting with physicians and other members of the healthcare team. An important aspect of professional interactions is the ability to use the language that others use at the bedside; whether a respiratory therapist, physician, nurse, or other healthcare professional, the language should always be the same.

Although this text is intended primarily for students, it will prove useful for other individuals as a reference

text. For the respiratory therapist who graduated from school some time ago, this text will serve as a refresher and update. For readers who are not respiratory therapists, the content should provide insight into respiratory therapy practice and serve as a reference text.

Innumerable persons must be thanked for their contributions to this project. First, I thank my co-editors. They embraced the vision and worked hard to make this text the best that it can be. Second, I thank all of the contributors, who dealt with my prodding to complete their chapters to my own and the publisher's expectations. Finally, I am grateful to the team at Jones & Bartlett

Learning, who poured their talents into this project and went out of their way to make this text second to none. The commitment of the Jones & Bartlett team has kept this project alive and moving forward.

It is my hope that the third edition of *Respiratory Care: Principles and Practice* will assist students in mastering the art and science of respiratory care, that it contributes to improvements in the stature of the respiratory care profession, and—most importantly—that it improves the care of patients with respiratory disorders.

Dean R. Hess, PhD, RRT, FAARC

Features

Respiratory Care: Principles and Practice, Third Edition incorporates a number of engaging pedagogical features to aid in the student's understanding and retention of the material. A colorful layout enables ease of comprehension and supports the retention of important concepts. More than 580 full-color photographs and more than 300 tables and equations provide valuable insight into the fundamental aspects of respiratory care practice.

Chapter Outline and Objectives

Each chapter begins with a framework for learning the most important topics by presenting an **Outline** indicating the material to be discussed and **Objectives** that list the chapter's desired learning outcomes.

OUTLINE

Creating a Therapeutic Climate
Components of the Health History
Vital Signs
Techniques of Assessment
Physical Examination of the Lungs and Thorax
Assessment of Other Body Systems

OBJECTIVES

1. Discuss the factors essential in the creation of a therapeutic climate.
2. Explain three considerations of an effective health history.
3. Explain the relevance of cultural diversity in the history-taking process.
4. List the major components of a health history.
5. Identify the four major examination techniques.
6. Define common terms used in assessment of the respiratory system.

Key Terms

Key Terms list the most important new terms covered in the chapter; correlating definitions can be found in the end-of-text glossary.

KEY TERMS

auscultation	orthopnea
barrel chest	pack years
Biot respirations	pallor
bradypnea	palpation
bronchial breath sounds	paradoxical respiration
bronchophony	paroxysmal nocturnal
bronchovesicular	dyspnea

Boxed Features

- **Respiratory Recap** Provides a review of key study points for core content
- **Stop and Think** New feature to this edition, which offers considerations for critical thinking and clinical decision making
- **Age-Specific Angle** Covers unique differences that are age specific—pediatric/neonatal focused or geriatric

Respiratory Recap

History of Present Illness

- Onset
- Location
- Duration
- Character
- Associated manifestations
- Relieving factors
- Treatment



STOP AND THINK

You are seeing a patient for the first time. You are told that the patient has COPD. What information would you collect regarding the patient's health history?

AGE-SPECIFIC ANGLE

Compared with adults, infants and children have higher respiratory rates, higher pulse rates, and lower blood pressures.

Tables

Key information is presented in a clear format for review and reference.

TABLE 1-4
Glasgow Coma Scale

Observation	Score
Eye Opening	
Spontaneous	4
In response to voice	3
In response to pain	2

Equations

Helpful equations provide an example to review and compute clinical calculations.

$$\text{Anion gap} = [\text{Na}^+] - ([\text{Cl}^-] + [\text{HCO}_3^-])$$

Clinical Practice Guidelines

These Guidelines list a review of *Indications*, *Contraindications*, *Hazards and Complications*, and *Limitations* according to AARC Clinical Practice Guidelines. The

Guidelines are crucial in the evaluation and management of patient care.

CLINICAL PRACTICE GUIDELINE 11-1

Metabolic Measurement with Indirect Calorimetry During Mechanical Ventilation

Indications

- Patients with known nutritional deficits or derangements. A number of nutritional risk and stress factors may considerably skew prediction by the Harris-Benedict equation, including neurologic trauma; paralysis; chronic obstructive pulmonary disease; acute pancreatitis; cancer with residual tumor burden; multiple trauma; amputation; patients whose height and weight cannot be accurately determined; patients who fail to respond adequately to estimated nutritional needs; new patients receiving home total parenteral nutrition; patients unable to eat who require mechanical ventilation for longer than 5 days; transplant patients; morbidly obese patients; and severely hypermetabolic or hypometabolic patients.
- To measure the O_2 cost of breathing in mechanically ventilated patients.
- To assess in mechanically ventilated patients to evaluate hemodynamic support.
- To measure cardiac output by the Fick method.
- To determine the cause(s) of increased ventilator requirements.

Contraindications

- When a specific indication is present, no contraindications exist to the performance of metabolic measurement with indirect calorimetry unless short-term disconnection of ventilatory support to allow connection of measurement lines results in hypoxemia, bradycardia, or other adverse effects.

Hazards and Complications

- Obtaining metabolic measurements with an indirect calorimeter is a safe, noninvasive procedure with few hazards or complications. However, under certain circumstances and with particular equipment, the following hazards or complications may be seen:
- Short-term disconnection of ventilatory support to allow connection of the indirect calorimetry apparatus may result in hypoxemia, bradycardia, or discomfort for the patient.
- Inappropriate calibration or system setup may produce erroneous values, resulting in incorrect patient management.
- Isolation valves may increase circuit resistance and cause increased work of breathing or dynamic hyperinflation or both.
- Inspiratory reservoirs may cause a reduction in alveolar ventilation due to increased compressible volume of the breathing circuit.
- Manipulation of the ventilator circuit may cause leaks that may lower alveolar ventilation.

Modified from AARC clinical practice guideline: metabolic measurement using indirect calorimetry during mechanical ventilation—2004 revision and update. *Respir Care*. 2004;49:1073–1079. Reprinted with permission.

Key Points

A list of bulleted statements appears at the end of each chapter. These **Key Points** recap a summary of the most important points in the chapter.

Key Points

- ▶ The health history provides a detailed, chronological record of the patient.
- ▶ The HPI offers a description of the onset of the problem, whether it developed suddenly, and the setting in which it developed.
- ▶ The four examination techniques commonly used are inspection, palpation, percussion, and auscultation.
- ▶ The use of accessory muscles implies an increased work of breathing.
- ▶ The assessment of respiratory expansion helps determine whether the lungs are expanding symmetrically.
- ▶ Auscultation of the chest allows assessment of diminished breath sounds, bronchial breath sounds, and adventitious breath sounds, such as crackles, rhonchi, wheezing, stridor, and pleural friction rubs.
- ▶ Listening to heart sounds involves notations of the rate and rhythm, extra heart sounds, and murmurs.



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