



Contents

PART I FOUNDATIONS OF CARDIOVASCULAR MEDICINE

1 Cardiovascular Disease: Past, Present, and Future, 1

EUGENE BRAUNWALD

2 Global Burden of Cardiovascular Disease, 14

THOMAS A. GAZIANO, DORAIRAJ PRABHAKARAN, AND J. MICHAEL GAZIANO

3 Impact of the Environment on Cardiovascular Health, 31

SADEER AL-KINDI AND SANJAY RAJAGOPALAN

4 Clinical Trials in Cardiovascular Medicine, 42

SCOTT D. SOLOMON AND JOHN MCMURRAY

5 Clinical Decision-Making in Cardiology, 53

JOHN E. BRUSH JR. AND HARLAN M. KRUMHOLZ

6 Impact of Health Care Policy on Quality, Outcomes, and Equity in Cardiovascular Disease, 62

KAREN E. JOYNT MADDOX

PART II INDIVIDUALIZING APPROACHES TO CARDIOVASCULAR DISEASE

7 Applications of Genetics to Cardiovascular Medicine, 71

PRADEEP NATARAJAN AND KIRAN MUSUNURU

8 Proteomics and Metabolomics in Cardiovascular Medicine, 87

ROBERT GERSZTEN

9 Principles of Drug Therapeutics, Pharmacogenomics, and Biologics, 92

DAN M. RODEN

10 Biomarkers and Use in Precision Medicine, 102

PETER LIBBY AND PAUL M RIDKER

11 Artificial Intelligence in Cardiovascular Medicine, 109

ZACHI ATTIA, SURAJ KAPA, PETER NOSEWORTHY, AND PAUL FRIEDMAN

12 Wearable Devices in Cardiovascular Medicine, 117

MINTU P. TURAKHIA

PART III EVALUATION OF THE PATIENT

13 History and Physical Examination: An Evidence-Based Approach, 123

JAMES C. FANG AND PATRICK T. O'GARA

14 Electrocardiography, 141

DAVID M. MIRVIS AND ARY L. GOLDBERGER

15 Exercise Physiology and Exercise Electrocardiographic Testing, 175

GARY J. BALADY AND PHILIP A. ADES

16 Echocardiography, 196

JUSTINA C. WU, LINDA D. GILLAM, AND SCOTT D. SOLOMON
ILLUSTRATED BY BERNARD BULWER

17 Chest Radiography in Cardiovascular Disease, 268

FRANCINE L. JACOBSON

18 Nuclear Cardiology, 277

SHARMILA DORBALA AND MARCELO F. DI CARLI

19 Cardiovascular Magnetic Resonance Imaging, 314

RAYMOND Y. KWONG

20 Cardiac Computed Tomography, 335

RON BLANKSTEIN

21 Coronary Angiography and Intravascular Imaging, 363

GEORGE D. DANGAS AND ROXANA MEHRAN

22 Invasive Hemodynamic Diagnosis of Cardiac Disease, 385

MORTON J. KERN, ARNOLD H. SETO, AND JOERG HERRMANN

**23 Anesthesia and Noncardiac Surgery in Patients with Heart Disease, 410**

LEE A. FLEISHER AND JOSHUA A. BECKMAN

PART IV PREVENTIVE CARDIOLOGY**24 The Vascular Biology of Atherosclerosis, 425**
PETER LIBBY**25 Primary Prevention of Cardiovascular Disease, 442**

SAMIA MORA, PETER LIBBY, AND PAUL M RIDKER

26 Systemic Hypertension: Mechanisms, Diagnosis, and Treatment, 471

GEORGE L. BAKRIS AND MATTHEW J. SORRENTINO

27 Lipoprotein Disorders and Cardiovascular Disease, 502

JACQUES GENEST, SAMIA MORA, AND PETER LIBBY

28 Cardiovascular Disease Risk of Nicotine and Tobacco Products, 525

ARUNI BHATNAGAR

29 Nutrition and Cardiovascular and Metabolic Diseases, 531

DARIUSH MOZAFFARIAN

30 Obesity: Medical and Surgical Management, 547

JEAN-PIERRE DESPRÉS, ERIC LAROSE, AND PAUL POIRIER

31 Diabetes and the Cardiovascular System, 556

NIKOLAUS MARX, SILVIO E. INZUCCHI, AND DARREN K. MCGUIRE

32 Exercise and Sports Cardiology, 579

PAUL D. THOMPSON AND AARON L. BAGGISH

33 Comprehensive Cardiac Rehabilitation, 588

RANDAL JAY THOMAS

34 Integrative Approaches to the Management of Patients with Heart Disease, 593

STEPHEN DEVRIES

PART V ATHEROSCLEROTIC CARDIOVASCULAR DISEASE**35 Approach to the Patient with Chest Pain, 599**
MARC P. BONACA AND MARC S. SABATINE**36 Coronary Blood Flow and Myocardial Ischemia, 609**

DIRK J. DUNCKER AND JOHN M. CANTY JR.

37 ST-Elevation Myocardial Infarction: Pathophysiology and Clinical Evolution, 636

BENJAMIN M. SCIRICA, PETER LIBBY, AND DAVID A. MORROW

38 ST-Elevation Myocardial Infarction: Management, 662

ERIN A. BOHULA AND DAVID A. MORROW

39 Non-ST Elevation Acute Coronary Syndromes, 714

ROBERT P. GIUGLIANO AND EUGENE BRAUNWALD

40 Stable Ischemic Heart Disease, 739

DAVID A. MORROW AND JAMES DE LEMOS

41 Percutaneous Coronary Intervention, 786

DHARAM J. KUMBHANI AND DEEPAK L. BHATT

42 Diseases of the Aorta, 806

ALAN C. BRAVERMAN AND MARC SCHERMERHORN

43 Peripheral Artery Diseases, 837

MARC P. BONACA AND MARK A. CREAGER

44 Treatment of Noncoronary Obstructive Vascular Disease, 859

SCOTT KINLAY AND DEEPAK L. BHATT

45 Prevention and Management of Ischemic Stroke, 870

MARK J. ALBERTS

PART VI HEART FAILURE**46 Mechanisms of Cardiac Contraction and Relaxation, 889**

DONALD M. BERS AND BARRY A. BORLAUG

47 Pathophysiology of Heart Failure, 913

GERD HASENFUSS AND DOUGLAS L. MANN

48 Approach to the Patient with Heart Failure, 933

JAMES L. JANUZZI JR. AND DOUGLAS L. MANN

49 Diagnosis and Management of Acute Heart Failure, 946

G. MICHAEL FELKER AND JOHN R. TEERLINK

50 Management of Heart Failure Patients with Reduced Ejection Fraction, 975

DOUGLAS L. MANN

51 Heart Failure with Preserved and Mildly Reduced Ejection Fraction, 1007

CAROLYN S.P. LAM, SANJIV J. SHAH, AND SCOTT D. SOLOMON



52 The Dilated, Restrictive, and Infiltrative Cardiomyopathies, 1031

RAY E. HERSHBERGER

53 Cardiac Amyloidosis, 1052

FREDERICK L. RUBERG AND MATHEW S. MAURER

54 Hypertrophic Cardiomyopathy, 1062

CAROLYN Y. HO AND STEVE R. OMMEN

55 Myocarditis, 1077

LESLIE T. COOPER JR. AND KIRK U. KNOWLTON

56 Cardio-Oncology: Managing Cardiotoxic Effects of Cancer Therapies, 1091

BONNIE KY

57 Cardio-Oncology: Approach to the Patient, 1099

JOERG HERRMANN

58 Devices for Monitoring and Managing Heart Failure, 1107

JOANN LINDENFELD AND MICHAEL R. ZILE

59 Mechanical Circulatory Support, 1119

KEITH D. AARONSON AND FRANCIS D. PAGANI

60 Cardiac Transplantation, 1132

RANDALL C. STARLING

PART VII ARRHYTHMIAS, SUDDEN DEATH, AND SYNCOPÉ

61 Approach to the Patient with Cardiac Arrhythmias, 1145

ANNE B. CURTIS AND GORDON F. TOMASELLI

62 Mechanisms of Cardiac Arrhythmias, 1163

STANLEY NATTEL AND GORDON F. TOMASELLI

63 Genetics of Cardiac Arrhythmias, 1191

JOHN R. GIUDICESSI, DAVID J. TESTER, AND MICHAEL J. ACKERMAN

64 Therapy for Cardiac Arrhythmias, 1208

JOHN M. MILLER AND KENNETH A. ELLENBOGEN

65 Supraventricular Tachycardias, 1245

JONATHAN M. KALMAN AND PRASHANTHAN SANDERS

66 Atrial Fibrillation: Clinical Features, Mechanisms, and Management, 1272

HUGH CALKINS, GORDON F. TOMASELLI, AND FRED MORADY

67 Ventricular Arrhythmias, 1288

WILLIAM G. STEVENSON AND KATJA ZEPPENFELD

68 Bradyarrhythmias and Atrioventricular Block, 1312

KRISTEN K. PATTON AND JEFFREY E. OLGIN

69 Pacemakers and Implantable Cardioverter-Defibrillators, 1321

MINA K. CHUNG AND JAMES P. DAUBERT

70 Cardiac Arrest and Sudden Cardiac Death, 1349

JEFFREY J. GOLDBERGER, CHRISTINE M. ALBERT, AND ROBERT J. MYERBURG

71 Hypotension and Syncope, 1387

HUGH CALKINS, THOMAS H. EVERETT IV, AND PENG-SHENG CHEN

PART VIII DISEASES OF THE HEART VALVES

72 Aortic Valve Stenosis, 1399

BRIAN R. LINDMAN, ROBERT O. BONOW, AND CATHERINE M. OTTO

73 Aortic Regurgitation, 1419

ROBERT O. BONOW AND RICK A. NISHIMURA

74 Transcatheter Aortic Valve Replacement, 1430

MARTIN B. LEON AND MICHAEL J. MACK

75 Mitral Stenosis, 1441

Y. S. CHANDRASHEKHAR

76 Mitral Regurgitation, 1455

REBECCA TUNG HAHN AND ROBERT O. BONOW

77 Tricuspid, Pulmonic, and Multivalvular Disease, 1473

PATRICIA A. PELLIKKA AND VUYISILE T. NKOMO

78 Transcatheter Therapies for Mitral and Tricuspid Valvular Heart Disease, 1484

HOWARD C. HERRMANN AND MICHAEL J. REARDON

79 Prosthetic Heart Valves, 1495

PHILIPPE PIBAROT AND PATRICK T. O'GARA

80 Infectious Endocarditis and Infections of Indwelling Devices, 1505

LARRY M. BADDOUR, NANDAN S. ANAVEKAR, JUAN A. CRESTANELLO, AND WALTER R. WILSON

81 Rheumatic Fever, 1531

ANA OLGA MOCUMBI



PART IX **DISEASES OF THE MYOCARDIUM, PERICARDIUM, AND PULMONARY VASCULATURE BED**

82 Congenital Heart Disease in the Adolescent and Adult, 1541

ANNE MARIE VALENTE, ADAM L. DORFMAN, SONYA V. BABU-NARAYAN, AND ERIC V. KRIEGER

83 Catheter-Based Treatment of Congenital Heart Disease in Adults, 1587

SHABANA SHAHANAFAZ, JOHN M. LASALA, AND DAVID T. BALZER

84 Cardiomyopathies Induced by Drugs or Toxins, 1593

ROBERT A. KLONER AND SHEREIF REZKALLA

85 Cardiovascular Abnormalities in HIV-Infected Individuals, 1603

PRISCILLA Y. HSUE AND DAVID D. WATERS

86 Pericardial Diseases, 1615

MARTIN M. LEWINTER, PAUL C. CREMER, AND ALLAN L. KLEIN

87 Pulmonary Embolism and Deep Vein Thrombosis, 1635

SAMUEL Z. GOLDBERGER AND GREGORY PIAZZA

88 Pulmonary Hypertension, 1656

BRADLEY A. MARON

89 Sleep-Disordered Breathing and Cardiac Disease, 1678

SUSAN REDLINE

PART X **CARDIOVASCULAR DISEASE IN SELECT POPULATIONS**

90 Cardiovascular Disease in Older Adults, 1687

DANIEL E. FORMAN, JEROME L. FLEG, NANETTE KASS WENGER, AND MICHAEL W. RICH

91 Cardiovascular Disease in Women, 1710

MARTHA GULATI AND C. NOEL BAIREY MERZ

92 Pregnancy and Heart Disease, 1723

SAMUEL C. SIU AND CANDICE K. SILVERSIDES

93 Heart Disease in Racially and Ethnically Diverse Populations, 1743

ALANNA A. MORRIS AND MICHELLE A. ALBERT

PART XI **CARDIOVASCULAR DISEASE AND DISORDERS OF OTHER ORGANS**

94 Endemic and Pandemic Viral Illnesses and Cardiovascular Disease: Influenza and COVID-19, 1751

ORLY VARDENY, MOHAMMAD MADJID, AND SCOTT D. SOLOMON

95 Hemostasis, Thrombosis, Fibrinolysis, and Cardiovascular Disease, 1766

JEFFREY I. WEITZ

96 Endocrine Disorders and Cardiovascular Disease, 1791

BERNADETTE BIONDI

97 Rheumatic Diseases and the Cardiovascular System, 1809

JUSTIN C. MASON

98 Tumors Affecting the Cardiovascular System, 1829

DANIEL J. LENIHAN, MICHAEL J. REARDON, AND W. GREGORY HUNDLEY

99 Psychiatric and Psychosocial Aspects of Cardiovascular Disease, 1841

KENNETH E. FREEDLAND, ROBERT M. CARNEY, ERIC J. LENZE, AND MICHAEL W. RICH

100 Neuromuscular Disorders and Cardiovascular Disease, 1853

WILLIAM J. GROH, ELIZABETH M. MCNALLY, AND GORDON F. TOMASELLI

101 Interface Between Renal Disease and Cardiovascular Illness, 1873

PETER A. MCCULLOUGH

102 Cardiovascular Manifestations of Autonomic Disorders, 1893

JASON S. BRADFIELD AND KALYANAM SHIVKUMAR