

Contents

SECTION I Overview and Basic Science of Radiation Oncology

- 1. The Discipline of Radiation Oncology** 2
Edward C. Halperin

PART A: Cancer Biology

- 2. Molecular Cancer and Radiation Biology** 71
Michael Baumann, Ina Kurth, Nils Cordes, Mechthild Krause, and Annett Linge

- 3. Biologic Basis of Radiation Therapy** 87
William H. McBride, H. Rodney Withers, and Dörthe Schäue

- 4. Molecular Pathophysiology of Tumors** 112
Rakesh K. Jain, John D. Martin, and Dan G. Duda

- 5. SMART Radiotherapy** 133
C. Norman Coleman, Pataje G. Prasanna, Jacek Capala, Mansoor M. Ahmed, Jeffrey C. Buchsbaum, Bhadrasain Vikram, and Eric J. Bernhard

PART B: Medical Radiation Physics

- 6. Principles of Radiation Physics and Dosimetry** 153
James A. Purdy and Sasa Mutic

- 7. Photon External-Beam Dosimetry and Treatment Planning** 180
James A. Purdy and Sasa Mutic

- 8. Electron Beam Therapy Dosimetry, Treatment Planning, and Techniques** 205
Angelica Perez-Andujar and Eric E. Klein

- 9. Conformal Radiation Therapy Physics, Treatment Planning, and Clinical Aspects** 230
James A. Purdy and Sasa Mutic

- 10. Physics and Dosimetry of Proton Therapy** 251
Brian Winey

- 11. Intensity-Modulated Radiation Treatment Techniques and Clinical Applications** 260
Tony J. C. Wang, Cheng-Shie Wuu, and K. S. Clifford Chao

- 12. Image-Guided Radiation Therapy** 288
Daniel Robert Simpson, Loren K. Mell, Arno J. Mundt, and Todd F. Atwood

SECTION II Techniques, Modalities, and Modifiers in Radiation Oncology

- 13. Altered Fractionation Schedules** 308
Anthony E. Dragun

- 14. Late Effects and QUANTEC** 329
John P. Kirkpatrick, Michael T. Milano, Jimm Grimm, Louis S. Constine, Zeljko Vujaskovic, and Lawrence B. Marks
- 15. Methodology of Clinical Trials** 371
Abigail T. Berman, Erin F. Gillespie, Clifton David Fuller, Yiyi Chen, and Charles R. Thomas Jr.
- 16. Stem Cell Transplantation and Total-Body Irradiation** 398
Sarah Jo Stephens, Kenneth B. Roberts, Zhe (Jay) Chen, Stuart Evan Seropian, and Chris R. Kelsey
- 17. Stereotactic Radiosurgery** 414
John C. Flickinger
- 18. Stereotactic Irradiation of Tumors Outside the Central Nervous System** 426
Brian D. Kavanagh, Jeffrey D. Bradley, and Robert D. Timmerman
- 19. Stereotactic Radiation Therapy Techniques** 436
Mark J. Amsbaugh and Shiao Y. Woo
- 20. Intraoperative Radiotherapy** 447
Timothy J. Kinsella
- 21. Proton Therapy** 455
Nancy P. Mendenhall and Zuofeng Li
- 22. Neutron Therapy and Boron Neutron Capture Therapy** 482
George E. Laramore
- 23. Carbon Ions** 492
Pascal Pommier, Stephanie E. Combs, and Tadashi Kamada
- 24. Patient Positioning Methods: Immobilization, Stabilization, and Monitoring** 506
Josh Evans, Bruce Libby, Laura Padilla, and Stanley H. Benedict
- 25. Physics and Biology of Brachytherapy** 530
Jeffrey F. Williamson and David J. Brenner
- 26. Clinical Applications of Brachytherapy: Low Dose Rate and Pulsed Dose Rate** 582
Sophie J. Otter, Caroline Holloway, Phillip M. Devlin, and Alexandra J. Stewart
- 27. The Physics and Dosimetry of High Dose Rate Brachytherapy** 607
Bruce Thomadsen and Rupak K. Das
- 28. Clinical Aspects and Applications of High Dose Rate Brachytherapy** 626
Subir Nag, Granger R. Scruggs, and John A. Kalapurakal
- 29. Radioimmunotherapy and Unsealed Radionuclide Therapy** 650
Tod W. Speer

30. Radiation Therapy and the Immune System	667
Chandan Guha, James W. Hodge, and Adam P. Dicker	
31. Photodynamic Therapy	680
Theodore E. Yaeger	
32. Reirradiation	695
Carsten Nieder and Anthony E. Dragun	
33. Global Radiation Oncology	705
Timothy P. Hanna and C. Norman Coleman	
34. Chemical Modifiers of Radiation Response	715
Yvonne Marie Mowery, David S. Yoo, and David M. Brizel	
35. Oncologic Imaging and Oncologic Anatomy	726
Juno P. Chino, Chris R. Kelsey, Jared D. Christensen, and Lawrence B. Marks	
36. Basic Concepts of Chemotherapy and Irradiation Interaction	751
D. Nathan Kim, Michael Story, and Hak Choy	

SECTION III Clinical Radiation Oncology

PART A: Skin

37. Skin	786
William M. Mendenhall, Anthony A. Mancuso, Jessica M. Kirwan, Peter T. Dziegielewski, and Christiana M. Shaw	

PART B: Central Nervous System

38. Primary Intracranial Neoplasms	799
Vinai Gondi, Michael A. Vogelbaum, Sean Grimm, and Minesh P. Mehta	

39. Pituitary Gland Cancer

Theodore E. Yaeger	838
--------------------	-----

40. Spinal Canal

Jiayi Huang, Clifford G. Robinson, and Jeff M. Michalski	846
--	-----

PART C: Head and Neck

41. Tumors of the Eye and Orbit	859
Nicholas J. Sanfilippo and Silvia C. Formenti	

42. Ear

Ti-Hao Wang and K. S. Clifford Chao	876
-------------------------------------	-----

43. Locally Advanced Squamous Carcinoma of the Head and Neck

David M. Brizel and Jessica L. Geiger	885
---------------------------------------	-----

44. Nasopharynx

Benjamin H. Lok, Jonathan E. Leeman, and Nancy Y. Lee	899
---	-----

45. Cancer of the Nasal Cavity and Paranasal Sinuses

Steven J. Frank, Anesa Ahamad, and Carlos A. Perez	936
--	-----

46. Salivary Glands

Chris H. J. Terhaard	956
----------------------	-----

47. Oral Cavity

Rafael R. Mañon, Jeffrey N. Myers, and Paul M. Harari	975
---	-----

48. Oropharynx

Joseph K. Salama and David M. Brizel	1005
--------------------------------------	------

49. Hypopharynx

Matthew E. Witek, Timothy J. Kruser, Henry T. Hoffman, Christopher J. Kandl, and Paul M. Harari	1026
---	------

50. Laryngeal Cancer

William M. Mendenhall, Anthony A. Mancuso, Robert J. Amdur, Brian J. Boyce, and Peter T. Dziegielewski	1043
--	------

51. Unusual Nonepithelial Tumors of the Head and Neck

Carlos A. Perez and Wade L. Thorstad	1063
--------------------------------------	------

52. Neck Cancer Including Carcinoma of Unknown Primary

William M. Mendenhall, Anthony A. Mancuso, Robert J. Amdur, Brian J. Boyce, and Peter T. Dziegielewski	1103
--	------

53. Thyroid Cancer

Robert J. Amdur and Roi Dagan	1121
-------------------------------	------

PART D: Thorax

54. Lung Cancer

Jing Zeng, Ramesh Rengan, Indrin J. Chetty, Roy H. Decker, Rafael Santana-Davila, Corey J. Langer, William P. O'Meara, and Benjamin Movsas	1137
--	------

55. Mediastinum and Trachea

Shervin M. Shirvani, Daniel R. Gomez, Clifton David Fuller, and Charles R. Thomas Jr.	1173
---	------

56. Esophageal Cancer

Brian G. Czito, Manisha Palta, and Christopher G. Willett	1206
---	------

57. Tumors of the Heart, Pericardium, and Great Vessels

Gregory M.M. Videtic and Roger M. Macklis	1244
---	------

PART E: Breast

58. Breast Cancer: Stage TIS

Alfredo I. Urdaneta, Todd Adams, David E. Wazer, and Douglas W. Arthur	1255
--	------

59. Breast Cancer: Early Stage

Sharad Goyal, Thomas Buchholz, and Bruce G. Haffty	1268
--	------

60. Breast Cancer: Locally Advanced, Part 1

Ron Y. Shiloh, Brandon A. Mahal, Serena Wong, Atif J. Khan, and Jennifer R. Bellon	1379
--	------

61. Breast Cancer: Locally Advanced, Part 2

Meena S. Moran and Pauline Truong	1395
-----------------------------------	------

PART F: Gastrointestinal

62. Stomach Cancer

Brian G. Czito, Manisha Palta, and Christopher G. Willett	1418
---	------

63. Pancreatic Cancer

Manisha Palta, Christopher G. Willett, and Brian G. Czito	1450
---	------

64. Cancer of the Liver and Hepatobiliary Tract

Mirrorer Ming-Jiung Liu, Tsun-I Cheng, Skye Hung-Chun Cheng, and Andrew T. Huang	1464
--	------

65. Cancer of the Colon and Rectum

Manisha Palta, Brian G. Czito, and Christopher G. Willett	1481
---	------

66. Anal Cancer

James D. Murphy	1502
-----------------	------

PART G: Urinary Tract

67. Cancer of the Kidney, Renal Pelvis, and Ureter

Hiram A. Gay and Jeff M. Michalski	1517
------------------------------------	------

68. Bladder Cancer

Carlos A. Perez	1532
-----------------	------

PART H: Male Genitourinary

69. Low-Risk Prostate Cancer

Carlos A. Perez, Jeff M. Michalski, and Michael J. Zelefsky	1560
---	------

70. Management of Intermediate- and High-Risk Prostate Cancer: What Do We Know?

Mack Roach III and Hans T. Chung	1602
----------------------------------	------

71. Testicular Cancer

Lucas C. Mendez and Gerard C. Morton	1623
--------------------------------------	------

72. Cancer of the Penis and Male Urethra

Hiram A. Gay and David B. Mansur	1637
----------------------------------	------

PART I: Gynecologic

73. Uterine Cervix	1651
Akila N. Viswanathan	
74. Endometrial Cancer	1740
Kaled M. Alektiar	
75. Ovarian and Fallopian Tube Cancer	1762
Larissa Lee, Ross Stuart Berkowitz, and Ursula A. Matulonis	
76. Vaginal Cancer	1786
Josephine Kang, Stephanie L. Wethington, and Akila N. Viswanathan	
77. Female Urethra	1817
Tony Y. Eng	
78. Carcinoma of the Vulva	1828
Junzo P. Chino, Brittany A. Davidson, and Gustavo S. Montana	

PART J: Adrenal and Retroperitoneal Tumors

79. Retroperitoneum	1845
Meng Xu-Welliver, Eric D. Miller, Joel L. Mayerson, Brian A. Van Tine, and Jeffrey C. Buchsbaum	
80. Adrenal Cancer	1856
Filip T. Troicki and John J. Coen	

PART K: Lymphoma and Hematologic Tumors

81. Hodgkin Lymphoma	1861
Richard T. Hoppe and Bradford S. Hoppe	
82. Non-Hodgkin Lymphomas	1882
Chris R. Kelsey, Jeremy M. Brownstein, Grace J. Kim, and Leonard R. Prosnitz	
83. Primary Cutaneous Lymphomas	1908
James E. Hansen, Youn H. Kim, Richard T. Hoppe, and Lynn D. Wilson	

84. Leukemia	1921
Kenneth B. Roberts, Gottfried von Keudell, and Nikolai Podoltsev	
85. Plasma Cell Myeloma and Plasmacytoma	1940
David C. Hodgson, Joseph Mikhael, and Richard W. Tsang	

PART L: Bone and Soft Tissue

86. Osteosarcoma and Other Primary Tumors of Bone	1952
Jaroslaw T. Hepel and Timothy J. Kinsella	
87. Soft Tissue Sarcoma (Excluding Retroperitoneum)	1962
Elizabeth H. Baldini	

PART M: Pediatric

88. Central Nervous System Tumors in Children	1977
Roger E. Taylor	
89. Wilms Tumor	2006
John A. Kalapurakal	
90. Neuroblastoma	2017
Arnold C. Paulino and Anita Mahajan	
91. Rhabdomyosarcoma	2028
Dana L. Casey, John C. Breneman, Sarah S. Donaldson, and Suzanne L. Wolden	

92. Ewing Tumor

Line Claude, Ronan Tanguy, and Marie-Pierre Sunyach 2044

93. Lymphomas in Children

Avani Dholakia Rao, Louis S. Constine, 2056
Stacy Lorine Cooper, and Stephanie A. Terezakis

94. Unusual Tumors in Children

Zachary Buchwald and Natia Esiashvili 2082

PART N: Benign Diseases**95. Nonmalignant Diseases**

Simon A. Brown, Jerry J. Jaboin, Tony Y. Eng,
Jose G. Bazan, and Charles R. Thomas Jr. 2103

SECTION IV Palliative and Supportive Care**96. Palliation of Brain and Spinal**

Cord Metastases 2134
Arpit Chhabra, Mark Mishra, Roy A. Patchell,
William Regine, and Young Kwok 329

97. Palliation of Bone Metastases

Alexander A. Harris and William F. Hartsell 2148

98. Palliation of Visceral Recurrences and

Metastases and Treatment of
Oligometastatic Disease 2163
Alexander A. Harris and William F. Hartsell

99. Cancer Pain: Assessment and Management 2172

Esther Yu, Paul Patrick Koffer, and Tracy A. Balboni

100. Palliative and Supportive Care

Paul Patrick Koffer, Esther Yu, and Tracy A. Balboni 2179

**SECTION V Economics, Education, Ethics,
and Technology Assessment****101. Technology Assessment, Outcome Analysis**

Research, Comparative Effectiveness,
and Evidence-Based Radiation Oncology 2192
Peter A. S. Johnstone, Carlos A. Perez, Edward C.
Halperin, Yolande Lievens, and Andre A. Konski

102. Error Avoidance

Bhishamjit S. Chera, Lukasz Mazur,
Prithima Mosaly, and Lawrence B. Marks 2208

103. Radiation Oncology Education

2220
Daniel W. Golden and Paris-Ann Ingledew

104. Ethics, Professional Values, and Legal

Considerations in Radiation Oncology 2252
Brian D. Kavanagh, Laurel J. Lyckholm,
and Jeremy Sugarman

105. Health Economics and Health Policy

2260
Ann C. Raldow, Eric M. Chang,
and Michael L. Steinberg

Index 2275