

# CONTENTS

## SECTION I Scientific Foundations of Radiation Oncology

### PART A Radiobiology

- 1 The Biological Basis of Radiation Oncology, 2**  
Elaine M. Zeman
- 2 Molecular and Cellular Biology, 39**  
Stephanie Markovina and Dennis E. Hallahan
- 3 Dose-Response Modifiers in Radiation Therapy, 48**  
Michael R. Horsman, Jacob C. Lindgaard, Cai Grau, Marianne Nordmark, Jan Alsner, and Jens Overgaard
- 4 Interaction of Chemotherapy and Radiation, 61**  
Christopher D. Willey, Eddy S. Yang, and James A. Bonner
- 5 Biologics and Their Interactions With Radiation, 78**  
Ye Yuan, Percy Lee, and David Raben

### PART B Physics

- 6 Radiation Oncology Physics, 93**  
J. Daniel Bourland
- 7 Radiation Physics: Stereotactic, 149**  
Timothy D. Solberg, Paul M. Medin, and Brian A. Hrycushko
- 8 Radiation Physics: Charged Particle Therapy, 160**  
Amanda J. Deisher, Jedediah E. Johnson, and Michael G. Herman

## SECTION II Techniques and Modalities

- 9 Surgical Principles, 171**  
Ryan W. Day and Y. Nancy You
- 10 Principles of Systemic Cancer Therapy, 181**  
Bruce A. Chabner and David P. Ryan
- 11 Imaging in Oncology, 197**  
Anup S. Shetty, Demetrios Raptis, and Hilary L. P. Orlowski
- 12 Nuclear Medicine, 219**  
Terence Z. Wong, Amir H. Khandani, and Arif Sheikh
- 13 Tumor Ablation in Interventional Radiology, 230**  
A. Nicholas Kurup and Matthew R. Callstrom
- 14 Overview of Oncology Clinical Trial Design, 237**  
Chen Hu, James J. Dignam, and Peixin Zhang
- 15 Health Services Research in Radiation Oncology: Toward Achieving the Achievable for Patients With Cancer, 248**  
William J. Mackillop, Timothy P. Hanna, and Michael D. Brundage
- 16 Radiation Therapy in the Elderly, 269**  
Noam VanderWalde and Grant Williams
- 17 Palliative Radiation Medicine, 276**  
Benjamin W. Corn, Ezra Hahn, and Nathan I. Cherny
- 18 Late Effects After Radiation, 290**  
Michael T. Milano, Lawrence B. Marks, and Louis S. Constine

## SECTION II Techniques and Modalities

- 19 Quality and Safety in Radiation Oncology, 314**  
Louis Potters, Suzanne B. Evans, and Todd Pawlicki
- 20 Brachytherapy, 325**  
Sophie J. Otter, Caroline L. Holloway, Desmond A. O'Farrell, Phillip M. Devlin, and Alexandra J. Stewart

- 21 Intensity-Modulated and Image-Guided Radiotherapy, 343**  
Mary Feng, Martha M. Matuszak, Ezequiel Ramirez, and Benedict A. Fraass
- 22 Intraoperative Irradiation, 371**  
Brian G. Czito, Felipe A. Calvo, Michael G. Haddock, Rachel Blitzblau, and Christopher G. Willett
- 23 Total Body Irradiation, 388**  
Christopher Andrew Barker, Jeffrey Y. C. Wong, and Joachim Yahalom
- 24 Charged Particle Radiotherapy, 408**  
Jacob E. Shabason, William P. Levin, and Thomas F. DeLaney
- 25 Targeted Radionuclide Therapy, 423**  
Joseph G. Jurcic, Jeffrey Y. C. Wong, Susan J. Knox, Daniel R. Wahl, Todd L. Rosenblat, Lucia Baratto, Andrei lagaru, Ruby F. Meredith, and Chul S. Ha
- 26 Immunotherapy With Radiotherapy, 438**  
Andrew G. Brandmaier and Silvia C. Formenti
- 27 Stereotactic Irradiation: CNS Tumors, 447**  
Christopher D. Abraham, Brian D. Kavanagh, and Jason P. Sheehan
- 28 Stereotactic Body Irradiation: Extracranial Tumors, 455**  
Brian D. Kavanagh and Robert D. Timmerman
- 29 Metastatic Disease: Bone, Spinal Cord, Brain, Liver, and Lung, 461**  
Kenneth Y. Usuki, Michael T. Milano, Marc David, and Paul Okunieff

## SECTION III Disease Sites

### PART A Central Nervous System Tumors

- 30 Overview, 479**  
Minesh P. Mehta and Rupesh R. Kotecha
- 31 Low-Grade Gliomas, 481**  
Hugues Duffau, Charles Eberhart, Matthew D. Hall, and Yazmin Odia
- 32 High-Grade Gliomas, 490**  
Dror Limon, Michal Raz, Andrew B. Lassman, and Benjamin W. Corn
- 33 Benign Brain Tumors: Meningiomas and Vestibular Schwannomas, 508**  
Michael D. Chan, C. Leland Rogers, Aadel A. Chaudhuri, John C. Flickinger, and Deepak Khunti
- 34 Pituitary Tumors and Craniopharyngiomas, 528**  
John H. Suh, Samuel T. Chao, Erin S. Murphy, and Pablo F. Recinos
- 35 Spinal Cord Tumors, 550**  
Rupesh R. Kotecha, Joseph A. Bovi, and Lilyana Angelov
- 36 Ocular, Orbital, and Optic Nerve Tumors, 570**  
Erqi Pollom, Beth M. Beadle, Arun D. Singh, and John H. Suh

### PART B Head and Neck Tumors

- 37 Overview, 591**  
Daniel J. Ma, Robert L. Foote, and K. Kian Ang
- 38 Oral Cavity, 600**  
William M. Mendenhall, Robert L. Foote, Peter T. Dziegielewski, and Rui P. Fernandes
- 39 Oropharyngeal Cancer, 627**  
George M. Cannon, Nabil F. Saba, and Paul M. Harari
- 40 Nasopharyngeal Carcinoma, 658**  
Joseph K. Kim, Nadeem Riaz, Roger Ove, Marsha Reygold, Robert L. Foote, James A. Bonner, Nancy Lee, and Chiaojung Jillian Tsai

**41 Larynx and Hypopharynx Cancer, 679**

Adam S. Garden and William H. Morrison

**42 Sinonasal Cancer, 704**

Jonathan J. Beitzler, Mark W. McDonald, C. Arturo Solares, Nabil F. Saba, and Patricia A. Hudgins

**43 Salivary Gland Malignancies, 725**

Jonathan J. Beitzler, Kelly R. Magliocca, Harry Quon, Ana Ponce Kiess, Christine H. Chung, and David W. Eisele

**44 Thyroid Cancer, 742**

Nicole M. Iñiguez-Ariza and Juan P. Brito

**45 Unknown Head and Neck Primary Site, 760**

William M. Mendenhall, Anthony A. Mancuso, and Peter T. Dziegielewski

**46 Management of the Neck, 767**

Vincent Grégoire, Thierry Duprez, Benoît Lengelé, and Marc Hamoir

**47 Cutaneous Carcinoma, 792**

Michael J. Veness and Julie Howle

**48 Malignant Melanoma, 806**

Matthew T. Ballo

**PART C Thoracic Neoplasms****49 Overview, 817**

Jeffrey A. Bogart

**50 Small Cell Lung Cancer, 825**

Michael Mix and Jeffrey A. Bogart

**51 Non-Small Cell Lung Cancer, 836**

Jordan A. Torok, Jeffrey M. Clarke, Betty C. Tong, and Joseph K. Salama

**52 Uncommon Thoracic Tumors, 868**

Vivek Verma, Stephen G. Chun, and Charles R. Thomas Jr

**PART D Gastrointestinal Tumors****53 Overview, 898**

Joel E. Tepper

**54 Esophagus-Gastric Cancer, 908**

Jonathan B. Ashman, Christopher L. Hallemeier, Zhong Wu, Adam Bass, Staci Beamer, and Joel E. Tepper

**55 Pancreatic Cancer, 946**

Joseph M. Herman, Amy C. Moreno, Christopher H. Crane, Christine A. Iacobuzio-Donahue, and Ross A. Abrams

**56 Hepatobiliary Cancer, 973**

Fumiko Chino, Manisha Palta, and Laura A. Dawson

**57 Colon Cancer, 995**

Brian G. Czito, David Hsu, Manisha Palta, and Christopher G. Willett

**58 Rectal Cancer, 1011**

Bruce D. Minsky, Claus M. Rödel, and Vincenzo Valentini

**59 Anal Carcinoma, 1037**

Christopher L. Hallemeier and Michael G. Haddock

**PART E Genitourinary Tumors****60 Overview, 1051**

Jeff M. Michalski

**61 Prostate Cancer, 1054**

Jeff M. Michalski, Thomas M. Pisansky, Colleen A. Lawton, and Louis Potters

**62 Bladder Cancer, 1115**

Michael J. LaRiviere, Brian C. Baumann, and John P. Christodouleas

**63 Testicular Cancer, 1132**

Peter W. M. Chung, Jeremy H. Lewin, Philippe L. Bedard, and Padraig R. Warde

**64 Kidney and Ureteral Carcinoma, 1150**

William W. Wong, Thomas B. Daniels, Jennifer L. Peterson, Mark D. Tyson, and Winston W. Tan

**65 Penile Cancer, 1170**

Juanita M. Crook

**PART F Gynecological Tumors****66 Overview, 1181**

Akila N. Viswanathan

**67 Cervical Cancer, 1184**

Akila N. Viswanathan, Lilian T. Gien, Don S. Dizon, and Wui-Jin Koh

**68 Endometrial Cancer, 1213**

Carien L. Creutzberg and Gini F. Fleming

**69 Cancers of the Vulva and Vagina, 1243**

Rebecca L. Stone and Sushil Beriwal

**70 Ovarian Cancer, 1276**

Julie My Van Nguyen, Tiffany C. Zigras, William Small Jr, and Allan Covens

**PART G Breast Cancer****71 Overview, 1297**

Ayah Al-Awadhi, Rashmi K. Murthy, and Abram Recht

**72 Noninvasive Breast Cancer, 1316**

Chirag Shah, Bindu Manyam, and Frank A. Vicini

**73 Breast Cancer: Stages I-II, 1325**

Abram Recht

**74 Locally Advanced and Inflammatory Breast Cancer, 1342**

Janet K. Horton

**PART H Sarcoma and Benign Disease****75 Soft-Tissue Sarcoma, 1359**

Kaled M. Alektiar

**76 Benign Diseases, 1386**

William G. Rule, Lisa A. McGee, Michael Heinrich Seegenschmidt, and Michele Y. Halyard

**PART I Childhood Cancers****77 Overview, 1398**

Larry E. Kun, Christopher L. Tinkle, and Jeff M. Michalski

**78 Central Nervous System Tumors in Children, 1403**

Ranjit S. Bindra and Shannon M. MacDonald

**79 Pediatric Soft-Tissue Sarcomas, 1421**

Michael W. Bishop, Christopher L. Tinkle, and Matthew J. Krasin

**80 Pediatric Sarcomas of Bone, 1431**

Nadia N. Issa Laack

**81 Wilms Tumor, 1442**

John A. Kalapurakal and Jeffrey S. Dome

**82 Retinoblastoma, 1453**

Anne-Marie Charpentier, Carlos Rodriguez-Galindo, and Carolyn R. Freeman

**83 Neuroblastoma, 1460**

Suzanne L. Wolden and Stephen S. Roberts

**84 Pediatric Leukemia and Lymphoma, 1468**

Amy Sexauer, John T. Sandlund Jr, and Karen J. Marcus

**85 Pediatric Hodgkin Lymphoma, 1477**

Kenneth B. Roberts, Bradford S. Hoppe, Kara M. Kelly, and Louis S. Constine

**86 Rare Pediatric Tumors, 1497**

Luke E. Pater, Ralph Vatner, and John Breneman

**PART J Lymphoma and Hematological Malignancies**

- 87 Overview**
- , 1511

*Andrea K. Ng*

- 88 Hodgkin Lymphoma**
- , 1516

*Andrea K. Ng and Ann S. LaCasce*

- 89 Non-Hodgkin Lymphoma**
- , 1531

*Karen M. Winkfield, Michael Farris, Mike Soike, Richard W. Tsang, and Mary K. Gospodarowicz*

- 90 Multiple Myeloma and Other Plasma Cell Neoplasms**
- , 1555

*Anuj Mahindra and Andrea K. Ng*

- 91 Mycosis Fungoides**
- , 1564

*Bouthaina S. Dabaja and Lynn D. Wilson**Foundations of Radiation Oncology***VIDEO CONTENTS****Video 20.1 Prostate Brachytherapy****Video 22.1 Intraoperative Radiation****Video 36.1 Ocular Melanoma****Video 65.1 Penile Brachytherapy**