## **Contents**

Preface to the First Edition iii Preface iv Acknowledgments v

## SECTION I For Students of Diagnostic Radiology, Nuclear Medicine, and Radiation Oncology $\ \ 1$

- 1 Physics and Chemistry of Radiation Absorption 2
- 2 Molecular Mechanisms of DNA and Chromosome Damage and Repair 11
- 3 Cell Survival Curves 35
- 4 Radiosensitivity and Cell Age in the Mitotic Cycle 54
- 5 Fractionated Radiation and the Dose-Rate Effect 67
- 6 Oxygen Effect and Reoxygenation 82
- 7 Linear Energy Transfer and Relative Biologic Effectiveness 101
- 8 Acute Radiation Syndrome 111
- 9 Medical Countermeasures to Radiation Exposure 126
- 10 Radiation Carcinogenesis 135
- 11 Heritable Effects of Radiation 162
- 12 Effects of Radiation on the Embryo and Fetus 177
- 13 Radiation Cataractogenesis 191
- 14 Radiologic Terrorism 197
- 15 Doses and Risks in Diagnostic Radiology, Interventional Radiology and Cardiology, and Nuclear Medicine 206
- 16 Radiation Protection 237

## SECTION II For Students of Radiation Oncology 257

- 17 Molecular Techniques in Radiobiology 258
- 18 Cancer Biology 295
- 19 Dose–Response Relationships for Model Normal Tissues 327
- 20 Clinical Response of Normal Tissues 351
- 21 Model Tumor Systems 380
- 22 Cell, Tissue, and Tumor Kinetics 398
- 23 Time, Dose, and Fractionation in Radiotherapy 417
- 24 Retreatment after Radiotherapy: The Possibilities and the Perils 437
- 25 Alternative Radiation Modalities 444
- 27 Chemotherapeutic Agents from the Perspective of a tion Biologist 475
- 28 Hyperthermia 516

Glossary 534 Index 564