

Subject Index

A

Abt-II study 397
abutment geometry 154
accelerated partial breast irradiation (APBI) 281
– dose optimization 284
– interstitial treatment 283
accelerator isocenter 212
acentric fragment 293
acquired immunodeficiency syndrome (AIDS) 580
acrylic
– mold 316
– plate 151
acute
– genitourinary toxicity 223
– lymphocytic leukemia (ALL) 786
– mucosal response 23
– myeloid leukemia (AML) 786
adenoid cystic carcinoma 472
adjacent field 100
afterloading
– nylon tubing 321
– silicone catheter 322
air cavity 145
air-kerma strength 262
alloy block 91, 93, 172, 417
alpha-fetoprotein (AFP) 740
American Brachytherapy Society (ABS) 274
anal canal 358, 547
– epidermoid carcinoma 360
anal cancer 48, 546, 549, 553
Anderson planar implant nomogram 343
androgen deprivation therapy (ADT) 716, 721
anesthesia 319
angiogenesis 61
anisotropy 265
Ann Arbor staging 808
anorectal carcinoma 358
anterior
– chest radiograph 790, 792
– fibromuscular stroma (AFS) 688
anteroposterior (AP) beam 438
anterosuperior point of the iliac spine (ASIS) 789
anthropomorphic phantom 213
AP/PA extended field 614
apoptosis 65, 294, 297
apparent activity 262
applicator insertion 271
aquaplast mask 454, 478
arc length 238

ASTRO failure definition 694
astrocytic tumor 430
asymmetric
– collimator jaw 664
– jaw 78
– X-ray collimator 77
atom bomb survivor 37
attenuation correction factor (ACF) 117
automatic
– optimization algorithm 274, 276
– positioning system (APS) 241
away-along table 263
axillar anatomy 487
axillary
– irradiation 508
– lymph nodes 486
– – dissection (ALND) 491
azygos node 526

B

Bacillus Calmette Guerin (BCG) 565
Bartholin's glands 631, 636
basal dose point 269
base of tongue 459
beam
– angulation 163
– arrangement design 184
– geometry 205
– modification 417
– penumbra 192
– quality 77
beam-edge penumbra 203
beamlet distribution 208
beam's eye view (BEV) 108, 179, 531, 699
belly board 613
benign prostatic hyperplasia 688
Beta-Cath system 837, 838
bifurcation 840
bilateral inguinofemoral lymphadenectomy 639
bile duct tumor 341, 342
biliary tree 341
bioanatomic radiation therapy 434
biological target volume (BTV) 119
biologically effective dose (BED) 6, 310, 787
– acute mucosal 17, 25
– late complications 14, 25
– tolerance zone 14

- biophysical model 196
 - bite block 168
 - registration 97, 98
 - bixel 203
 - intensity 205
 - bladder 706
 - cancer 47, 357, 474, 561
 - - chemotherapy 566
 - - composite isodose curve 570
 - - IMRT 573
 - - isodose distribution 570
 - - staging system 564
 - - target volume 569
 - therapeutic options 564
 - diagram 562, 563
 - distension 550
 - exstrophy 561
 - irritability 561
 - mucosa 569
 - preservation 574, 575
 - tumor, see also bladder cancer 427
 - - location 568
 - wall 221
 - Bloedorn applicator 354
 - blood
 - cell count (CBC) 659
 - test 805
 - body immobilization system 169
 - bone
 - density 144
 - interface 85
 - scan 758
 - bone marrow transplantation 785
 - bone-tissue interface 145
 - bony
 - metastasis 428
 - sacral promontory 571
 - boost
 - brachytherapy 343
 - treatment 493
 - bore-size limitation 182
 - Bowen's disease 634
 - brachytherapy 255
 - applicators 596
 - dose rate 257
 - endoluminal 514
 - high dose rate (HDR) 279, 305, 379
 - interstitial technique 268
 - line source dosimetry 263
 - low dose rate (LDR) 306, 338
 - of the breast 335
 - permanent implant 256
 - point source dosimetry 262
 - preplanning 270
 - quality control procedures 367
 - radiation protection 285
 - remote controlled 380
 - source
 - - half life 258
 - - strength 261
 - strength specification 262
 - temporary implant 256
 - transperineal permanent implant 274
 - treatment planning 273
 - brain
 - anatomy 425
 - metastasis 432, 448
 - metastatic tumor 428
 - BrainLab m3 collimator 243
 - breast anatomy 486
 - breast cancer 389, 485
 - anterior supraclavicular-axillary photon field 505
 - biopsy 490
 - brachytherapy 335
 - electron beam technique 507
 - field planning 495
 - irradiation 495
 - locoregional tumor 488
 - partial irradiation 500
 - partly-deep tangential pair fields 505
 - staging 490
 - standard brachytherapy 500
 - supine tangential treatment 494
 - bremsstrahlung photon beam 208
 - Brodmann schema 426
 - bronchogenic carcinoma 339, 526
 - imaging 528
 - X-ray 528
 - bronchoscopy 385, 512
 - Brown-Roberts-Wells (BRW)
 - frame 321
 - localizing ring 234
 - buccal mucosa 150, 460
 - bulky
 - cancer 462
 - disease 826
 - - upper mediastinum 827
- C**
- camptothecin 43
 - cancer
 - of the laryngopharynx 459
 - of the nasopharynx 460
 - of the tonsillar region 459
 - carboplatin 43, 45
 - carcinoembryonic antigen (CEA) 545
 - carcinoma
 - of nasal vestibule 474
 - of posterior pharyngeal wall 458
 - of the base of tongue 459
 - of the cervix 345, 382, 595
 - - applicators 347
 - - survival rates 595
 - of the endometrium 352, 383
 - of the esophagus 340, 386
 - - chemotherapy 516
 - - clinical target volume (CTV) 516
 - - dose volume histogram (DVH) 520
 - - gross target volume (GTV) 516
 - - metal stent placement 514
 - - palliation 514
 - - plan implementation 521
 - - planning target volume (PTV) 516
 - - quality assurance 521
 - - radiochemotherapy 516

- of the glottic larynx 455
- of the lung
 - tumor dose 531
- of the nasopharynx 329, 461
- of the pancreas 341
- of the penis 360
- of the prostate
 - external irradiation 696
- of the tongue 331
- of the tonsillar region 475
- of the uterine cervix 35, 305, 346, 593
- of the vagina 657
 - high-dose-rate intracavitary brachytherapy 666
 - lymph node metastasis 662
 - staging 661
 - treatment options 662
- of the vulva 632, 625
 - treatment guidelines 641
- cardiac irradiation 495
- cataract 303
- catheter
 - insertion 271, 272, 281
 - misconnection 285
 - position 273
- cecum 547
- cell survival curve 9, 293
- cell-cycle mechanism 41
- central nervous system (CNS) 425
 - meningioma 440
 - metastatic tumors 448
 - neoplasm 428
 - primary tumors 447
 - tumor 427
 - imaging 430
 - imaging-based treatment planning 434
 - medical treatment 431
 - radiation therapy 432
 - surgical management 431
- cerrobend 91, 148
 - block 172, 447
 - calm shell 800
 - insert 160
- cervical cancer, see also carcinoma of the cervix, cervix
 - cancer 266, 305, 579
 - beam fields 583
 - complications 594
 - FIGO staging 580
 - LDR brachytherapy 586
 - radiation treatment 581
- cervical spine block 821
- cervix
 - biopsy 659
 - cancer 47
- cesium
 - implant 467
 - needle 332, 468
- cesium-137 259, 260
- chamber and electrometer system 277
- chemoirradiation 39, 652
 - non-small cell lung cancer 44
 - small cell lung carcinoma 44
- chest wall 153
 - boost field 796
 - electron beam field 504
 - tangential photon field 503
- Chinese hamster (CHO) cell 296
- choline-to-N-acetylaspartate ratio 434
- choroidal melanoma 324
- chromatid aberration 292
- chromatin 292
- chromosome
 - aberration 292
 - damage 296
- cigarette smoking 525
- cisplatin 47, 519, 567, 624
- Clarkson integration 791
- clinical target volume (CTV) 147, 283, 343, 479
- Cloquet's node 632
- cobalt beam 747
- cobalt-60 260, 457
 - teletherapy 82
 - machine 210
- Collaborative Ocular Melanoma Study (COMS) 324
 - trial of preenucleation radiation 326
- collimation system 112, 170
- collimator
 - angle indicators 404
 - jaw 170, 407
 - scatter factor 73
- colon cancer 545, 547, 548
 - therapeutic ration 555
- color-coded silk thread 312
- colorectal cancer 50, 547
- colostomy 48, 359, 553
- colpectomy scar 611
- colpostat 345, 347, 384
- commissioning 214
- compensating filter 95, 211
- compensation system 172, 173
- computed tomography (CT) 58
 - 16-slice scanner 112
 - 4D imaging 58
 - CT-compatible radiographic marker 281
 - large-bore scanner 111
 - multislice scanner 110
 - scan parameters 124
 - simulation 108, 109, 126, 282
 - instruction 121
 - slice thickness 283
 - topogram 181
- concomitant boost 21
- concurrent chemotherapy 43
- cone
 - beam 208
 - modulation technique 211
 - system 158
- conformity index 235
- continuous
 - hyperfractionated accelerated radiotherapy (CHART) 532
 - low dose-rate (CLDR) 295
- Continuous Accelerated Irradiation (CAIR) 18, 21
- contrast 128
- conventional
 - linac 242
 - radiation therapy (CRT) 219
 - simulator 110, 124

- convexity meningioma 441
 - convolution kernel 194
 - core needle biopsy 759
 - coronary artery disease 837
 - Corvus system 219
 - couch
 - angles 238
 - coordinate 129
 - Coulomb force interaction 136
 - craniospinal
 - field arrangement 161
 - irradiation (CSI) 102, 160, 444, 446
 - craniocaudal isocenter position 518
 - Crohn's disease 718
 - cross-sectional tissue anatomy 191
 - Cu-ATSM 119
 - custom compensating bolus 151, 174
 - CyberKnife 241
 - treatment system 244
 - cystectomy 47, 565, 566, 568
 - cystogram 568, 569
 - cystoscopy 278, 349, 562, 572
- D**
- dacarbazine 775
 - DAHANCA curve 20, 21
 - Dale's formalism 310
 - data
 - acquisition 400, 415
 - transfer error 416
 - database management system (DBM) 200
 - delayed feedback 13
 - Delclos cylinder 608, 619, 665
 - delta ray 137
 - Denonvillier's fascia 678
 - dental acrylic 150
 - 18F-deoxyglucose (FDG) 64
 - dexamethasone 431
 - dicentric 293
 - DICOM 130, 199
 - diethylenetriamine pentaacetic acid (DTPA) 61
 - digitally
 - composite radiograph (DCR) 185
 - reconstructed radiograph (DRR) 108, 216, 522
 - distal urethral tumor 358
 - distance to agreement (DTA) 213
 - DNA double-strand breaks (DSB) 40
 - documentation 187
 - dog-leg configuration 742
 - Dolasetron 801
 - Domed cylinder 665
 - donor lymphocytes 785
 - dose
 - calculation 416
 - – algorithm 186, 194
 - distribution homogeneity 284
 - falloff 160
 - homogeneity 190
 - – index (DHI) 281
 - per monitor unit 74
 - perturbation factor (DPF) 85
 - precision 395
 - profile 73
 - – horns 82
 - specification 99
 - volume histogram (DVH) 70, 194, 322, 434, 479
 - dose-modifying factor (DMF) 381
 - dose-rate effect 296
 - dose-volume statistics 196
 - dosimetric
 - margin 435, 707
 - parameter 70
 - verification 212
 - dosimetrist
 - staffing 397
 - training 397
 - dosimetry
 - check 187
 - instrumentation 224
 - system 213
 - double-strand break (DSB) 292
 - doxorubicin 624, 772, 775, 778
 - drug–radiation interaction 40
 - dummy
 - source 323
 - wire 311
 - dwelt
 - position 280
 - time 280, 284
 - dynamic
 - multileaf collimation (DMLC) technique 218
 - tracking software 244
 - wedge 173
 - – technology 408
 - dysuria 722
- E**
- early responding tissue 298
 - ecchymosis 757
 - effective pathlength (EPL) 79
 - EGFR 43
 - electrocardiogram (ECG) 801
 - electron
 - arc therapy 159
 - beam 135, 144
 - – bolus 151
 - – lung tissue 144
 - – obliquity factor 143
 - – treatment
 - chest wall boost 797
 - cone 158
 - density 174
 - depth–dose distribution 143
 - disequilibrium 194
 - dose profile 140
 - field 152
 - percentage depth dose 138
 - shielding 149
 - electronic portal imaging
 - device (EPID) 213
 - – online 419
 - quality assurance 411

electron-photon field matching 156
 Elekta stereotactic body frame 438
 endobronchial radiation 385
 endoluminal brachytherapy 514
 endometrial cancer (EC) 352, 599
 – clinical staging system 603
 – palliation 624
 – prognosis 605
 endometrial hyperplasia 600
 endometrioid adenocarcinoma 601
 endoscopic ultrasound (EUS) 512
 energy spectrum 258
 en-face beam 224
 enhanced dynamic wedge (EDW) 86, 87, 94
 enteritis 556
 EPID support 410
 epidermal growth factor receptor (EGFR) 12
 epidermoid carcinoma 640
 – of the anal canal 360
 epididymis 740
 epiglottic tip cancer 456
 episcleral plaque therapy 324
 epithelioid sarcoma 778
 equivalent dose 6
 equivalent uniform dose (EUD) 198
 erectile dysfunction 723
 erythroplasia of Queyrat 634
 erythropoietin 46
 esophageal
 – cancer, see also carcinoma of the esophagus 47, 339, 386, 511, 512
 – wall 513
 esophagectomy 49, 514, 519
 esophagitis 45, 530
 esophagus
 – adenocarcinoma 515
 – cancer 48
 estrogen 600
 estrogen-secreting tumor 600
 Ethernet 199
 ethmoid sinus cancer 468, 469
 exact-match technique 445
 exit dose 83
 exophytic invasive squamous cell carcinoma 461
 external beam radiation therapy (EBRT) 344, 381, 725
 extracranial
 – stereotactic radioablation (ESR) 678
 – target 248
 extrapolated
 – response dose (ERD) 11, 318
 – tolerance dose (ETD) 10
 extraprostatic extension (EPE) 700
 extraskeletal chondrosarcoma of the extremities 771
 eye shield 164
 eyelid cancer 471

F

facemask 98
 fan-beam IMRT delivery 208
 fecal incontinence 556
 fibrous histiocytoma 756

fiducial marker 574
 field
 – abutment 152
 – size 76
 – – indicator 404
 File Transfer Protocol (FTP) 199
 first-echelon lymph node 465
 fistula
 – recto-vaginal 678
 – tracheobronchial 515
 – tracheoesophageal 515
 – uretero-vaginal 679
 – vesico-vaginal 679
 flatness 139
 flattening filter 205
 Fletcher milligram hours 587, 590, 592
 Fletcher-Suit afterloading colpostat 611
 Fletcher-Suit applicator 617
 Fletcher-Suit-Declos (FSD)
 – applicator 266
 – LDR system 348
 – tandem 317, 586
 floor of the mouth cancer 463, 464
 fluorinated pyrimidine 39
 18F-fluorodeoxy-glucose 806
 – PET scan 759
 fluoroscopy 125, 278
 foam device 169
 FOCAL unit 234
 Foley
 – balloon 266
 – catheter 278, 345, 569, 593
 formalin fixation 701
 French spring-eye needle 314
 frog-leg position 642
 5-FU 43, 49, 553, 567
 functional mapping 426

G

gadolinium (Gd) 61
 Gamma Knife 233, 237, 238, 240
 – isodose distribution 246
 gamma slope 15
 gamma-37 15
 gamma-50 15, 26
 gantry 208, 242
 Gap-Match technique 445
 gastric cancer 511
 Gelfoam 316
 gemcitabine 46
 genetic disorder 33
 genitourinary diaphragm 709
 germ cell tumor 739
 Gill-Thomas-Cosman (GTC) frame 234
 Gleason score 690, 694, 720
 glioblastoma 321
 – multiforme 51, 322
 glioma 51, 428
 glottic larynx cancer 454
 GOG protocol 603, 605

- gold
 – fiducial marker 700
 – seed 584
 – – implantation 705
 gold-198 260
 gonadal shielding 746
 Gortec II 22
 graft-versus-host disease (GVHD) 785
 groin node 646
 gross target volume (GTV) 147, 283
 gutter guide technique 313
 GYN tandem 267
 gynecological cancer 266
 gypsum 174
- H**
- half-value layers (HVL) 171
 hand calculation 416
 head and neck
 – cancer 45, 387, 453
 – – RT techniques 453
 – compensator 793
 – intensity-modulated radiation therapy 480
 – schedule 16, 18, 19
 – tumor 327
 heart irradiation 830
 HeLa cell 296
 hematuria 561
 hemiscrotum 747
 hemivulvectomy 649
 hemoptysis 386
 Henschke technique 311, 349
 Heyman-Simon capsule 352, 608
 High Dose Accelerated Dose-Per-Fraction Escalation (HARDE) 18, 21
 high dose rate (HDR) system 280
 – fractionation schemes 381
 high-energy electron 135
 high-Z material 206
 hilar adenopathy 821
 Hodgkin's disease 36, 805, 807
 – advanced stage 812
 – Ann Arbor classification 807
 – combined modality therapy 810
 – infradiaphragmatic 810
 – mantle fields 815
 – spade-shape fields 823
 – subdiaphragmatic fields 823
 hot loading 390
 hot spot 481
 human
 – chorionic gonadotropin (HCG) 740
 – lymphocyte antigen (HLA) 785
 – papilloma virus (HPV) 579
 hydronephrosis 580, 676
 hydroxyl radical 291
 Hypaque 593
 hyperfractionation (HFX) 16, 17, 532
 hyperthermia 367
 hypofractionation 24
 hypopharynx cancer 476, 477
 hypothyroidism 831
 hypoxia 41, 65
 hysterectomy 383, 581, 585, 593, 608, 675
 hysteroqram 352
- I**
- ICRU report 38 266
 ifosfamide 778
 ileal conduit 565
 image
 – transfer 129
 – verification review 419
 image-guided radiation therapy (IGRT) 167, 575
 imaging chain 110
 immobilization system 97, 120, 168
 – of the breast 120
 implant
 – of the mediastinum 339
 – removal 320
 inelastic collision 137
 infant irradiation 798
 in-field sarcoma 35
 inflammatory bowel disease 718
 infrahyoid epiglottic cancer 456
 inguinal lymph node 674
 – dissection 642
 intensity modulated radiation therapy (IMRT) 26, 27, 36, 57, 167, 180, 203, 436, 478
 interface dosimetry 83
 interfraction 181
 interlobar node 526
 internal
 – mammary chain (IMC) 499
 – – radiation 507
 – shielding 149, 175
 – target volume (ITV) 189
 International Commission on Radiation Units and Measurement (ICRU) 188
 interseed attenuation 277
 interstitial pneumonitis 788
 intracavitary
 – brachytherapy (ICB) 599
 – cylinder 355
 – radiation 157
 – vaginal brachytherapy (IV) 610
 intrafraction 181
 intraoperative radiation therapy (IORT) 147, 157, 158
 intraoral cone irradiation 464, 468
 intraperitoneal radioisotope 610
 intrathoracic disease 806
 intratubular germ cell neoplasia (IGCN) 739, 746
 intrauterine tandem 345, 666
 introitus 613
 inverse
 – method 203
 – planning 248
 – square law 310
 iodine-125 260
 – permanent interstitial implants 314
 – plastic tube implants 313
 ion chamber 73, 403
 iridium 329
 – fork 360
 – hairpin 332

- implant 467
- wire 300, 301, 310, 313
- iridium-192 260, 300
- implants 366, 459
- interstitial brachytherapy 353
- - gynecological malignancy 353
- irregular skin surface 142
- irregular-field calculation 76
- ischial tuberosities 552, 698, 706, 744
- isocenter 168
- isodose
- location 125
- charts 81
- curve 73, 140
- distribution 89, 153, 212
- line 139, 142
- shift method 79, 80
- surface 189
- isotope 720

- J**

- jaw
- setting 94
- system 171

- K**

- Kaposi's sarcoma 176
- Karnofsky performance score 322
- kidney blocking 799
- kilovoltage X-ray simulator system 207

- L**

- labia majora 631
- lactate dehydrogenase (LDH) 492, 740
- laminectomy 432
- laparotomy 357, 806
- large mediastinal mass (LMM) 806
- laryngectomy 46
- larynx cancer 476, 477
- Las Vegas phantom 410
- late responding tissue 298
- lateral
- fluence gradient 215
- pelvis field 614
- L-block shield 271
- lead
- cutout 148
- shield 175
- lead time bias 57
- leaf position 216
- leaf-center insertion 93
- Leksell frame 240
- length time bias 57
- leukapheresis 786
- leukemia 444
- Lhermitte sign 830
- lidocaine 320, 552

- lifestyle 33
- LiF-Teflon dosimeter 84
- light-radiation field congruence test 403
- limb
- perfusion protocol 777
- salvage procedure 777
- line source dosimetry 263
- linear accelerator (linac) 37, 136, 207, 241
- computer control system 406
- radiosurgery 235
- linear energy transfer (LET) radiation 291
- linear quadratic (LQ)
- equation 383
- formalism 318
- formula 6
- - Seven Steps 8
- - simple 9
- model 295
- lip cancer 462
- liposarcoma 756, 775
- Lipowitz metal 91, 172
- lithium fluoride (LiF) 793
- lithotomy position 320, 363
- liver transmission block 615
- lobectomy 529
- local
- anesthesia 320
- area network (LAN) 199
- log-linear plot 294
- lumpectomy 272, 335, 493
- cavity 282
- lung
- block 795, 797, 820, 821
- cancer 193, 234, 386, 525
- - fractionation 532
- - metastatic 385
- - TNM classification 527
- compensator 792, 793
- heterogeneity 535
- interface 84
- parenchyma 830
- toxicity 536
- tumor
- - target delineation 534
- lung-chest wall interface 147, 797
- lung-density corrections 536
- Lyman model 197
- lymph node
- chain 826
- in lung 526
- in mediastinum 526
- lymphadenectomy 47, 633, 675
- lymphangiogram 571, 740
- lymphatic drainage 486
- lymphedema 474, 566, 646
- lymphoma 44
- lymphoscintigraphy 487, 507

- M**

- machine calibration 792
- MACH-NC study 45

magnetic resonance imaging (MRI) 59
 – diffusion-weighted (DWMRI) 64
 – functional (fMRI) 64
 – simulator 114
 malignancy, treatment-related 34
 malignant
 – fibrous histiocytoma 768
 – melanoma 23
 Mallinckrodt system 618
 mammography 489
 MammoSite applicator 389, 501
 Manchester system 299, 347, 588
 mantle field 815, 819
 – arm positions 818
 Martinez universal perineal interstitial template (MUPIT)
 315
 Martius flap 679
 mass of radium 261
 mastectomy scar 504
 match-line wedge 101
 mathematical models 7
 maxillary sinus cancer 468
 maxillectomy 328
 median lobe hyperplasia (MLH) 716
 mediastinoscopy 528
 mediastinum 827
 medical accelerator facilities
 – quality assurance 412
 medical event 287, 368
 medullablastoma 101
 meningococcus 807
 menometrorrhagia 600
 mesorectal excision 50
 metallic esophageal stent 514
 metastatic disease 778
 Mick applicator 275, 277
 milligram hour system 588
 milligram-radium equivalent 262
 minicolpostat 348
 miniovoid 348
 misadministration 370
 mitomycin 553
 mitotic death 294
 mixed lymphocyte culture (MLC) 785
 modulation
 – of intensity 187
 – transfer function (MTF) 410
 mold 316
 monitor unit 215
 – calculation 75
 mons pubis 631
 Monte Carlo simulation 194, 310
 mucosal tolerance 13
 mucosis fungoides 176
 mucositis 20, 458
 multileaf collimator (MLC) 78, 92, 111, 171, 179, 203, 206, 408
 multiple coplanar beam arrangement 620
 multiple-beam arrangement 88
 multislice CT scanner 110
 MUPIT applicator 359, 668
 myelopathy 436
 myxoid liposarcoma 760

N

nasal
 – cavity cancer 468, 469
 – vestibule 328
 – – carcinoma 472
 nasopharyngeal carcinoma (NPC) 46, 218, 454
 nasopharynx 387
 National Marrow Donor Program (NMDP) 786
 neck dissection 476
 necrosis 649
 needle
 – insertion 278
 – loading boxes 275
 neoadjuvant hormone therapy (NHT) 727
 nephritis 745
 neuraxis irradiation 445
 neutron flux field 258
 nominal standard dose (NSD) 7
 non-coplanar
 – beam arrangement 440, 620
 – method 707
 – photon beam 501
 non-Hodgkin's lymphoma 808
 nonseminomatous germ cell tumor (NSGCT) 739
 non-small cell lung cancer 44, 193, 530, 534
 nonsquare beam 70
 non-uniform
 – beam fluences 209
 – distribution 269
 normal tissue complication 69
 – probability (NTCP) 197
 Novalis treatment system 244
 Nuclear Regulatory Commission (NRC) 286
 nucleosid analog 41
 nylon catheter 311

O

ocular melanoma 325
 off-axis factor 73
 off-axis ratio (OAR) 78, 139
 off-center ratio (OCR) 73, 78
 oncological imaging 57
 oophoropexy 823, 831
 open-bladder implant 357
 operating room (OR) 256
 – requirements 158
 optic chiasm 245, 437
 optical distance indicator (ODI) 403
 optimization
 – algorithm 209, 284
 – criterion 209
 oral
 – cavity 331
 – tongue 465
 orchidectomy 740, 748
 organs at risk (OAR) 147, 435
 oropharynx 333, 457
 orthogonal field 103
 orthovoltage
 – beam 746

- X-ray unit 89
- Orton study 306
- overlapping voxel 192
- ovoid 349, 587, 608
- implant 267
- oxaliplatin 43

- P**
- paclitaxel 45
- PACS system 236
- Paget's disease 634
- palladium-103 260
- implants 366
- palliative external beam radiotherapy 625
- pancytopenia 786
- Pap smear 580
- paraaortic lymph node 828
- paraffin wax 174
- parametrium 349, 660
- paravaginal tumor 356
- Paris system 269, 300, 313, 338
- Parker-Paterson dosimetry system 300
- parotid gland 472
- cancer 474
- parotidectomy 475
- partial tumor volume (PTV) 220
- particle beam radiosurgery 238
- Paterson-Parker system 269
- patient
- immobilization 119, 415
- positioning 97, 99, 114, 119, 125
- - reference point 168
- support assembly (PSA) 410
- PDR procedure 368
- Peacock system 206, 222
- pediatric tumor 388
- pelvic
- cancer 350
- field 216
- irradiation 346
- lymph node 641, 696
- - dissection 693
- - elective irradiation 644
- - metastases 690
- lymphadenectomy 566
- radiotherapy field 555
- recurrence 622, 674
- treatment
- - radiation field 571
- wall point 591
- pelvis 587
- pencil-beam method 194
- penile bulb 723
- penumbra 93, 101, 141, 189
- peptic ulcer 742
- percentage
- depth dose (PDD) 70, 86
- positive prostate biopsy (PPPB) 695
- percutaneous transluminal coronary angioplasty (PTCA) 837
- pericarditis 830
- permanent prostate implant
- treatment planning 276
- volume study 275
- PET/CT
- combination scanner 59
- combined 116
- simulator 116
- pharyngeal wall lesion 456
- phenytoin 431
- phosphocholine 61
- phosphoethanolamine 61
- phospholipid anabolite 61
- photon
- beam 193
- - target definition 146
- contamination 137
- field 152, 161
- photon-beam
- dosimetry 81
- radiation output calibration constancy 403
- physic staffing 396
- physical wedges 173
- physics training 397
- pilot image 126
- Pipelle examination 600
- pituitary adenoma 439
- planar dosimeter 213
- planning
- conference 418
- organ at risk volume (PRV) 147, 189
- target volume (PTV) 147
- plaster casting technique 98
- plastic
- constancy phantom 403
- tandem 347
- pneumococcus 807
- pneumonectomy 529
- pneumonitis 531, 536, 798
- point source dosimetry 262
- polyethylene foam 169
- polymer 213
- polystyrene 160
- phantom 217
- polyurethane foam system 98, 767
- port film verification review 419
- PORTEC trial 620
- positron emission tomography (PET) 64, 512
- postbrachytherapy prostate volume 720
- posterior fossa simulation 442
- posteroanterior (PA) beam 438
- post-implant dosimetry 279
- postmastectomy 156
- irradiation 499, 501
- Post-Operative Therapy in Endometrial Carcinoma (PORTEC) trial 604, 606
- postprostatectomy (PPI) IMRT 223
- post-radical prostatectomy radiation therapy 714
- potency 361
- potentially lethal damage repair (PLDR) 40
- pouch of Douglas 657
- preauricular field 823
- Premarin 659
- pretreatment quality assurance 284
- proctitis 651

prone pillow 169
 prostate
 – brachytherapy 361, 386, 715
 – – radioisotopes 362
 – – selection criteria 362
 – – TRUS-guided permanent 275
 – cancer 22, 34, 59, 60, 220, 234, 386, 687
 – – brachytherapy 724
 – – cigarette smoking 718
 – – clinical target volume (CTV) 700
 – – dose prescription 711
 – – external beam radiation therapy 721
 – – HDR-BT monotherapy 727
 – – neoadjuvant hormone therapy (NHT) 727
 – – obesity 718
 – – organs at risk 706
 – – patient positioning 699
 – – postoperative radiation therapy 713
 – – PSA spikes 721
 – diaphragm 709
 – gland 687
 – implant 287
 – – radiation exposure 287
 – mobility 703
 – size 715
 – TRUS-guided implants 363
 – volume 365
 prostatectomy 689, 701, 727
 prostate-specific antigen (PSA) 688, 690
 prostatic
 – acid phosphatase 718
 – carcinoma 688
 – – regional lymph node involvement 690
 prostatitis 717
 prostheses 85
 proton 37
 – beam radiotherapy 771
 PSA spike 721
 psychosexual rehabilitation 638
 pterygium 326
 pterygomaxillary implant 334
 pubic arch interference 717
 pulmonary metastases 778
 pulse dose rate (PDR) 310, 317
 – brachytherapy (PDR) 302
 – – schedule 304
 pyrifrom sinus cancer 456
 pyrimidine 41

Q

QA/CQI committee 398
 Qualified Medical Physicist (QMP) 396
 quality
 – checklist 250
 – control 395
 – management program 596
 quality assurance 214, 235, 250, 395
 – clinical aspects 418
 – education lectures 405
 – IMRT 411
 – linac

– – advanced technology 405
 – – annual test 405
 – medical linear accelerator 400
 – of simulators 401
 – test 403
 – treatment planning
 – – computer system 414
 – – non-graphical 415
 – – three-dimensional 415
 – – traditional graphical 415
 – typical responsibilities 399
 Quetelet index 644
 Quimby system 269

R

radiation
 – beam location 203
 – block 203
 – direct action 291
 – exposure risk 287
 – necrosis 321
 – oncology chart 418
 – pneumonitis 830
 – safety 302, 320
 – – control 288
 – therapy simulator 107
 Radiation Therapy Oncology Group (RTOG) 17
 radical prostatectomy 727
 radioactive
 – materials license 286
 – phosphorus-32 626
 radiochromic film 212, 238
 radionuclide 310
 radio-opaque
 – contrast 278
 – dummy source 336
 – marker 272, 337, 438, 444, 552
 radiotherapy technology 109
 radium 259, 332
 – needle 301
 – source 587
 radium-226 259
 radon-222 259
 random uncertainty 395
 Random phantom 37
 ratio of tissue phantom ratios and off-axis ratio corrections
 (RTPROAR) 237
 – algorithm 237
 Ray-tack vaginal packing 608
 rectal
 – balloon 222
 – cancer 49, 50, 545
 – – chemotherapy 549
 – – irradiation 549
 – – surgery 549
 – – therapeutic ration 555
 – morbidity 722
 – mucosa 356, 358
 – ulceration 366
 – ultrasound probe 363
 – wall 221, 548

rectovaginal fistula 649, 678
 rectum 706
 recurrent endometrial cancer 621
 Reed-Sternberg cell 809
 reference
 – air kerma rate 590
 – mark 128
 – vessel diameter (RVD) 839
 regional lymphatics 481
 registration
 – image-based 130
 – point-based 130
 – surface-based 130
 relative effectiveness 11
 remote control afterloading 317
 removable media 199
 reporting dose 190
 reproductive death 294
 restenosis of the coronary artery 837
 retinoblastoma 324
 – gene 579
 rhabdomyosarcoma 756, 775
 Robinson catheter 340
 room's eye view (REV) 184
 – display 184
 rotation axis 241
 rotational therapy technique 89

S

sacral canal 550
 safety interlock 406
 sagittal laser 114
 saphenous vein graft in-stent restenosis 840
 sarcoma 272
 – high-grade 779
 – of soft tissues 756
 – of the extremities 771
 – of the hand and foot 773
 – radiation-induced 35
 scan
 – field of view (SFOV) 112
 – limit 128
 – protocol 126, 128
 scanner laser 114
 scatter–air ratio (SAR) 72
 scatter–maximum ratio (SMR) 72
 Schiller's iodine 659
 sciatic pain 676
 scopolamine 331
 scrotal interference 747
 scrotum 740
 second malignant neoplasm 749
 secure room 271
 SEER program 34, 35, 599
 segmented treatment table (STT) 408
 seminoma 739
 sentinel lymph node surgery 488
 setup margin (SM) 188
 Seven Steps to LQ Heaven 8
 sexual activity 579
 shallow breathing 117

shielding 91
 – block 184
 shift method 129
 Sievert
 – integral 263
 – summation 310
 sigmoid colon 546
 Silastic plastic insert 325
 Simon-Heyman capsule 617
 simulated annealing 210
 simulation
 – request form 127
 – software 110
 simulator
 – film 216
 – geometry 118
 – tabletop 113
 single-plane implant 269
 single-strand break 291
 Skene's glands 636
 skin and lip tumor 329
 skin cancer 316, 390
 small cell lung carcinoma 44, 537
 – cell lines 537
 – prophylactic cranial irradiation 538
 soft palate cancer 460
 soft tissue sarcoma (STS) 343, 388, 755
 – biopsy 759
 – brachytherapy 766
 – combination chemotherapy regimen 773
 – grading 760
 – neoadjuvant chemotherapy 776
 – of the extremities 755
 – positive/negative margins 763
 – proton beam radiotherapy 771
 – radiation treatment technique 767
 – radical resection 762
 – rhabdomyosarcoma 775
 – surgical margins 763
 – wound complication 773
 – wound healing 773
 software update 406
 source
 – curator 367
 – housing 240
 – loading 274
 source-axis distance 82, 444, 744
 source-film distance (SFD) 789
 source-skin distance (SSD) 136, 141, 744, 789
 source–skin ratio 79
 spatial cooperation 39
 spermatogenesis impairment 749
 spermatogonia 749
 sphincter preservation 554
 spinal
 – cord
 – – myelopathy 436
 – – tolerance 831
 – – tumor 428
 – metastasis 448
 – tumor 446
 spleen 829
 splenectomy 806, 823

spoiler plus tray factor (STF) 792
 spread-out Bragg peak 771
 squamous cell carcinoma 634
 – of floor of mouth 466
 – of right lateral wall of nasal vestibule 473
 – of the lower lip 463
 – of the oral tongue 467
 – of the proximal vagina 663
 – of the vagina 657
 stage migration 57
 stainless steel 311
 stand-alone PET 116
 standard fractionation 16
 Stanford technique 162, 176
 stem cell transplantation 785
 stereotactic
 – body frame (SBF) 248
 – body radiotherapy (SBRT) 678
 – collimation system 238
 – frame 236
 – radiosurgery 233
 stereotaxy 236
 sternocleidomastoid muscle 497
 Stockholm system 347
 stretcher 176
 Styrofoam 172
 – wedges 120, 170
 subcutaneous tumor 777
 sublethal damage repair (SLDR) 40
 superposition principle 261
 supraclavicular nodal irradiation 497
 Syed-Neblett
 – applicator 622
 – interstitial implant 608
 – template 314, 668
 Syed-Puthawala-Hedger esophageal applicator 340
 synovial sarcoma 756, 775
 systematic uncertainty 3995

T

tamoxifen 600
 tandem 384
 target
 – delineation 113
 – geometry 214
 – specification 99
 – volume 188
 – – uncertainties 416
 taxane 41, 43, 46, 48
 Teflon
 – 16-gauge tubing 311
 – Angiocath catheter 323
 – catheter 336, 349
 teleangiectasis 678
 template 314
 temporal lobe lesion 441
 testicular
 – boost 798
 – cancer 739
 – – staging 741
 – shielding 743, 746

tetraazacyclododecane tetraacetic acid (DOTA) 61
 TG43 formalism 263, 277
 thalamic tumor 442
 thermoluminescent dosimeter 83, 160, 163, 212, 265, 418
 – powder capsule 794
 thermoplastic mask 168, 211, 234
 thoracic radiotherapy (TRT) 537
 – treatment planning 533
 thoracotomy 339
 thorax board 533
 three dimensional
 – conformal radiation therapy (3D CRT) 179
 – treatment planning 180
 thromboembolism 595
 through-and-through technique 331
 thymus block 800
 thyroid
 – carcinoma 219
 – gland 831
 tibial osteosarcoma 60
 time-dose factor (TDF) 6, 7
 tissue
 – deficit (TD) 790
 – inhomogeneities 79
 – – correction 79
 – toxicity 217
 tissue-air ratio (TAR) 71, 79, 80
 – power law method 80
 tissue-equivalent bolus 96
 tissue-maximum ratio (TMR) 71
 tissue-phantom ratio (TPR) 71
 titanium shell 287
 tobacco 718
 tolerance zone 18
 – of early BED 26
 tomotherapy 90, 206, 211, 800
 tongue carcinoma 331
 tonsillar region 334
 topical chemotherapy 650
 total
 – abdominal hysterectomy and bilateral salpingo-oophorec-
 tomy (TAH-BSO) 604
 – dose 6
 – limb irradiation 155
 – scalp treatment 157
 – skin electron therapy 162, 176
 – skin irradiation 148
 total body irradiation (TBI) 167, 175, 786
 – compensators 790
 – – design 791
 – compensators 790
 – – thickness 791
 – dose verification 793
 – gonad shielding 800
 – in young children 801
 – kidney shielding 799
 – lung shielding 798
 – normal tissue shielding 798
 – technique setup sheet 796
 Tpot 13
 tracheal stoma 457
 tracheobronchial fistula 515
 tracheoesophageal fistula 515

Tracking Cobalt Project 210
 transabdominal ultrasound 703
 – images of the prostate 705
 transhepatic cholangiogram 342
 transition zone cancer 688
 transperineal implant technique 362
 transrectal ultrasound (TRUS) 270, 274, 320, 669, 724
 transurethral
 – bladder resection (TURBT) 562, 565
 – resection 358
 – – of the prostate (TURP) 363, 696, 717
 transvaginal ultrasonography 601
 treatment
 – machines maintenance 414
 – planning 69, 96, 417
 treatment-planning computer system
 – quality assurance 414
 true pelvis 550
 truncal sarcoma 769
 T-stage tumor 219
 tumor
 – control probability (TCP) 11, 197, 198
 – failure rate 536
 – hypoxia 65
 – in the cervicothoracic region 446
 – in the temporal region 441
 – in the thoracic region 447
 – node metastasis (TNM) system 761
 – – soft tissue sarcoma 761
 – of nasal cavity 471
 – of oral cavity 468
 – of oropharynx 468
 – of paranasal sinuses 471
 – of the head and neck 327
 – of the meninges 427
 – of the proximal urethra 360
 – of the rectovaginal septum 356
 – phenotype 118
 – radioenhancement 43
 – repopulation 12, 25
 – response 20
 – shape 203
 – skin and lip 329
 tumor-soft tissue interface 193
 tungsten
 – leaves 210
 – shield 266
 tunica albuginea 747

U
 ultrasmall superparamagnetic iron oxide (USPIO) 62
 uncertainty
 – random 395
 – systematic 395
 unspecified tissue 196
 until center point (UCP) 240

uretero-vaginal fistula 679
 urethral stricture 358, 722
 urethritis 712
 urethrogram 698
 urethroscopy 562
 urinary
 – epithelium 562
 – morbidity 721
 – toxicity 364
 – tract infection 561
 uterine
 – bleeding 600
 – tandem 354
 uterus 599
 uveal melanoma 326

V

Vac-Lok cradle 494
 vacuum form body immobilization 170
 vagina
 – adenocarcinoma 675
 – clear cell adenocarcinoma 658
 – clear cell carcinoma 675
 – lymphatic drainage 658
 vaginal
 – applicator 354
 – cancer 657
 – – chemotherapy 682
 – – FIGO stages 673
 – – inguinal-femoral nodal irradiation 664
 – – interstitial brachytherapy 671
 – carcinoma 351
 – cuff 611
 – cylinder 345, 353, 354, 611, 665, 666
 – fistula 678
 – intraepithelial neoplasia (VAIN) 650, 658, 659
 – – FIGO staging 669
 – – staging 659
 – length 626
 – mucosa 346
 – surface 384, 613
 – – dose 592
 – vestibule 631
 vaginectomy 662
 α/β value 382
 Varian Trilogy system 245
 vasculogenesis 61
 velocity effect 159
 vesico-vaginal fistula 679
 video-assisted thoracoscopic surgery (VATS) 528
 vinyl polysiloxane obturator 327
 virtual simulation software 110, 117
 – capability 130
 vocal cord cancer 454
 volume study 275
 voxel 194

vulva
 - cancer 358, 635
 - brachytherapy 646
 - chemoradiation 651
 - irradiation 638
 - lymph node metastasis 637
 - organ preservation 637
 - pregnancy 649
 - wound infection 648
 - intraepithelial neoplasia 650
 - malignant melanoma 650
 - melanoma 636
 - recurrence 676
 - sarcoma 636
 - sarcoma 649
 - tumor diagnosis 634
 vulvectomy 633, 638, 647
 vulvo-vaginal recurrence 677

W

Waldeyer's ring field 823
 wall laser 114
 Wang classification 328
 wedge
 - angle 74
 - factor 74
 - filter 74
 - - dosimetry 85
 - isodose curves 74
 whole
 - abdominal irradiation (WAI) 607, 618
 - brain irradiation 443
 - pelvis field 614

whole-body irradiation 76
 whole-body phantom 217
 World Health Organization formulation 760
 wound
 - healing problem 344
 - morbidity 774

X

x-axis 194, 195
 xerostomia 454, 824, 831
 xiphoid 503
 X-jaw 95, 171, 407
 X-ray 33, 107137, 217, 291
 - collimator 81, 160
 - films 125
 - simulator 180
 - tube 120

Y

y-axis 195
 Y-jaw 95, 171, 407
 y-ray 37, 291
 Y-shaped applicator 384
 ytterbium-169 261
 yttrium-90 838

Z

Z value 150
 zirconium-90 838

List of Contributors

RON R. ALLISON, MD
Professor and Chairman
Department of Radiation Oncology
Leo Jenkins Cancer Center
Brody School of Medicine
Greenville, NC 27834
USA

HIGINIA R. CARDENES, MD, PhD
Clinical Associate Professor
Department of Radiation Oncology, RT 041
Indiana University School of Medicine
535 Barnhill Dr
Indianapolis, IN 46202
USA

ROBERT J. AMDUR, MD
Department of Radiation Oncology
University of Florida College of Medicine
Health Science Center
P.O. Box 100385
Gainesville, FL 32610-0385
USA

WALTER H. CHOI, MD
Department of Radiation Oncology
SUNY Downstate at Brooklyn
450 Clarkson Avenue, Box 1211
Brooklyn, NY 11203
USA

JEFFREY D. BRADLEY, MD
Department of Radiation Oncology
Washington University School of Medicine
4921 Parkview Place – Lower Level
Mail Stop #90-38-635
St. Louis, MO 63110
USA

L. CHINSOO CHO, MD
Department of Radiation Oncology
The University of Texas Southwestern
Medical Center at Dallas
5801 Forest Park
Dallas, TX 75390-9183
USA

DAVID J. BRENNER, PhD, DSc.
Professor of Radiation Oncology
and Public Health
Center for Radiological Research
Columbia University Medical Center
630, West 168th St.
New York, NY, 10032
USA

HAK CHOY, MD
Professor and Chair
Department of Radiation Oncology
Nancy B. and Jake L. Hamon Distinguished
Chair in Basic Cancer Research
The University of Texas Southwestern
Medical Center at Dallas
5801 Forest Park
Dallas, TX 75390-9183
USA

THOMAS A. BUCHHOLZ, MD
Department of Radiation Oncology
The University of Texas
M.D. Anderson Cancer Center
1515 Holcombe Boulevard, Unit 1202
Houston, TX 77030
USA

FILIP CLAUS, MD, PhD
Memorial Sloan-Kettering Cancer Center
1275 York Avenue
New York, NY 10021
USA

THOMAS F. DELANEY, MD
 Medical Director
 Northeast Proton Therapy Center
 Massachusetts General Hospital
 Harvard Medical School
 30 Fruit Street
 Boston, MA 02114
 USA

KATHRYN E. DUSENBERY, MD
 University of Minnesota Medical School
 Department of Radiation Oncology
 MMC436
 420 Delaware St. S.E.
 Minneapolis, MN55455
 USA

ROBERT E. DRZYMALA, MD
 Associate Professor in Radiation Oncology Physics
 Department of Radiation Oncology
 Wahington University School of Medicine
 4921 Parkview Place
 Campus Box 8224
 St. Louis, MO 63110
 USA

JACK F. FOWLER, DSc, PhD
 Emeritus Professor
 of Human Oncology and Medical Physics
 Medical School of University of Wisconsin –
 Madison, WI, USA
 Former Director of the Gray Laboratory,
 Nothwood, London, UK
Present address:
 150 Lambeth Rd.
 London SE1 7DF
 UK

DAN P. GARWOOD, MD
 Department of Radiation Oncology
 UT Southwestern Medical Center at Dallas
 5801 Forest Park
 Dallas, Texas 75390-9183
 USA

BRUCE J. GERBI, PhD
 Associate Professor
 Therapeutic Radiology – Radiation Oncology
 University of Minnesota
 Mayo Mail Code 494
 420 Delaware St SE
 Minneapolis, MN 55455
 USA

SRI GORTY, MD
 Radiation Oncologist
 Robert and Beverly Lewis Cancer Care Center
 Ponom Valley Hospital Medical Center
 1910 Royalty Drive
 Pomona, CA
 USA

LEONARD L. GUNDERSON, MD
 Chair, Department of Radiation Oncology
 Mayo Clinic, Scottsdale, Arizona
 Professor of Oncology
 Mayo Clinic College of Medicine
 Department of Radiation Oncology
 200 2nd St. SW DeskR
 Rochester, MN 55905
 USA

MICHAEL G. HADDOCK, MD
 Consultant, Division of Radiation Oncology
 Mayo Clinic, Scottsdale, Arizona
 Associate Professor of Oncology
 Mayo Clinic College of Medicine
 Department of Radiation Oncology
 200 2nd St. SW DeskR
 Rochester, MN 55905
 USA

ERIC J. HALL, D.Phil., D.Sc. FACR, FRCR
 Higgins Professor of Radiation Biophysics
 Center for Radiological Research
 Columbia University
 630, West 168th St.
 New York, NY, 10032
 USA

DAVID C. HARMON, MD
 Hematology Oncology, Department of Medicine
 Massachusetts General Hospital
 Harvard Medical School
 Yawkey 7944
 30 Fruit Street
 Boston, MA 02114
 USA

Francis J. Hornicek, MD, PhD
 Orthopedic Oncology
 Department of Orthopaedic Surgery
 Massachusetts General Hospital
 Harvard Medical School
 Yawkey 3B
 30 Fruit Street
 Boston, MA 02114
 USA

HEDVIG HRICAK, MD, PhD
 Chairman, Department of Radiology
 Carroll and Milton Petrie Chair
 Professor of Radiology, Weill Medical College
 Cornell University, Memorial Sloan-Kettering
 Cancer Center
 1275 York Avenue
 New York, NY 10021
 USA

ERIC KLEIN, MS
 Department of Radiation Oncology
 Washington University School of Medicine
 St. Louis, MO 63110
 USA

CHUNG KYU KIM LEE, MD
 University of Minnesota Medical School
 MMC494
 420 Delaware St.S.E.
 Minneapolis, MN 55455
 USA

SEYMOUR H. LEVITT, MD
 Professor, Department of Therapeutic Radiation
 Oncology MMC 436
 University of Minnesota Hospital
 420 Delaware St SE
 Minneapolis, MN 55455
 USA
and
 Foreign Adjunct Professor
 Karolinska Institute Stockholm, Sweden

ZUOFENG LI, DSc
 Associate Professor
 Division of Radiation Physics
 Washington University Medical Center
 4921 Parkview Place, Campus Box 8224
 St. Louis, MO 63110
 USA

DANIEL A. LOW, PhD
 Associate Professor
 Division of Radiation Physics
 4921 Parkview Place, Campus Box 8224
 St. Louis, MO 63110
 USA

WEI LU, PHD
 Department of Radiation Oncology
 4921 Parkview Place, Campus Box 8224
 St. Louis, MO 63110
 USA

JAMES A. MARTENSON JR., MD
 Consultant, Division of Radiation Oncology
 Mayo Clinic
 Professor of Oncology
 Mayo Clinic College of Medicine
 Department of Radiation Oncology
 200 2nd St. SW DeskR
 Rochester, MN 55905
 USA

KEVIN P. McMULLEN, MD,
 Assistant Professor, Department of
 Radiation Oncology
 Wake Forest University School of Medicine
 Medical Center Blvd.
 Winston-Salem, NC 27157-1030
 USA

MARSHA D. McNEESE, MD
 Department of Radiation Oncology
 The University of Texas
 M.D. Anderson Cancer Center
 1515 Holcombe Boulevard, Unit 1202
 Houston, TX 77030
 USA

WILLIAM M. MENDENHALL, MD
 Department of Radiation Oncology
 University of Florida College of Medicine
 Health Science Center
 P.O. Box 100385
 Gainesville, FL 32610-0385
 USA

GREGORY S. MERRICK, MD
 Schiffler Cancer Center
 and Wheeling Jesuit University
 Wheeling, WV 26003
 USA

JEFF M. MICHALSKI, MD, MBA
 Associate Professor in Radiation Oncology
 Department of Radiation Oncology
 Washington University School of Medicine
 4921 Parkview Place, Campus Box 8224
 Saint Louis, MO 63110
 USA

GERARD C. MORTON, MD, MRCPI FRCPC
 Assistant Professor, Division of Radiation Oncology
 Toronto-Sunnybrook Regional Cancer Centre,
 University of Toronto
 2075 Bayview Avenue
 Toronto, Ontario M4N 3M5
 Canada

SABIN B. MOTWANI, MD
 Department of Radiation Oncology
 The University of Texas
 M.D. Anderson Cancer Center
 1515 Holcombe Boulevard, Unit 1202
 Houston, TX 77030
 USA

MICHAEL T. MUNLEY, PhD
 Associate Professor, Department of Radiation
 Oncology
 Wake Forest University School of Medicine
 Medical Center Blvd.
 Winston-Salem, NC 27157-1030
 USA

SASA MUTIC, MS
 Department of Radiation Oncology
 Washington University School of Medicine
 4921 Parkview Place
 St. Louis, MO 63110
 USA

SUBIR NAG, MD, FACR, FACRO
 Chief of Brachytherapy
 Department of Radiation Medicine
 Arthur G. James Cancer Hospital and Solove
 Research Institut
 The Ohio State University
 300 West 10th Avenue, # 072
 Columbus, Ohio 43210
 USA

SAMIR NARAYAN, MD
 Department of Radiation Oncology
 University of California Davis Medical Center
 4501 X Street, Suite G126
 Sacramento, CA 95817
 USA

STEN NILSSON, MD
 Professor, Institution for Oncology Pathology
 Karolinska University Hospital
 17176 Stockholm
 Sweden

JATINDER R. PALTA, PhD
 Department of Radiation Oncology
 University of Florida College of Medicine
 Health Science Center
 P.O. Box 100385
 Gainesville, FL 32610-0385
 USA

MARIA PEARSE, MD, MB ChB FRANZCR
 Division of Radiation Oncology
 Toronto-Sunnybrook Regional Cancer Centre,
 University of Toronto
 2075 Bayview Avenue
 Toronto, Ontario M4N 3M5
 Canada

CARLOS A. PEREZ, MD
 Professor, Department of Radiation Oncology
 Washington University Medical Center
 4511 Forest Park Boulevard, Suite 200
 St. Louis, MO 63108
 USA

JAMES A. PURDY, PhD
 Professor and Vice Chairman
 Department of Radiation Oncology
 Chief, Physics Section
 University of California Davis Medical Center
 4501 X Street, Suite G140
 Sacramento, CA 95817
 USA

KEITH M. RICH, MD
 Associate Professor, Neurological Surgery
 Department of Neurological Surgery
 Wahington University School of Medicine
 660 South Euclid Avenue
 Campus Box 8057
 St. Louis, MO 63110
 USA

ANDREW E. ROSENBERG, MD
 Surgical Pathology, Department of Pathology
 Massachusetts General Hospital
 Harvard Medical School
 Warren 2
 30 Fruit Street
 Boston, MA 02114
 USA

MARVIN ROTMAN, MD
 Distinguished Service Professor and Chairman
 Department of Radiation Oncology
 State University of New York
 Health Science Center at Brooklyn
 450 Clarkson Ave., Box 1211
 Brooklyn, NY 11203-2098
 USA

ALAN R. SCHULSINGER, MD
 Clinical Associate Professor of Radiation Oncology
 Department of Radiation Oncology
 State University of New York
 Health Science Center at Brooklyn
 Box 1211
 450 Clarkson Ave.
 Brooklyn, NY 11203-2098
 USA
and
 Director of Radiation Oncology at
 Long Island College Hospital

EDWARD G. SHAW, MD
 Professor and Chairman, Department of
 Radiation Oncology
 Wake Forest University
 School of Medicine
 Medical Center Blvd.
 Winston-Salem, NC 27157-1030
 USA

JOSEPH R. SIMPSON, MD
 Associate Professor in Radiation Oncology
 Department of Radiation Oncology
 Campus Box 8224
 4921 Parkview Place
 St. Louis, MO 63110
 USA

VOLKER W. STIEBER, MD
 Assistant Professor, Department of
 Radiation Oncology
 Wake Forest University
 School of Medicine
 Medical Center Blvd.
 Winston-Salem, NC 27157-1030
 USA

ERIC A. STROM, MD
 Department of Radiation Oncology
 The University of Texas
 M.D. Anderson Cancer Center
 1515 Holcombe Boulevard, Unit 1202
 Houston, TX 77030
 USA

BRENT TINNEL, MD
 Indiana University School of Medicine
 Department of Radiation Oncology
 535 Barnhill Drive, RT 041
 Indianapolis, IN 46202
 USA

PRABHAKAR TRIPURANENI, MD
 Scripps Clinic/Scripps Green Hospital
 10666 N. Torrey Pines Rd., MSB-1
 La Jolla, CA 92037-1092
 USA

SRINIVASAN VIJAYAKUMAR, MD
 Chair, Department of Radiation Oncology
 University of California Davis Medical Center
 4501 X Street, Suite G126
 Sacramento, CA 95817
 USA

IMRAN ZOBERI, MD
 Department of Radiation Oncology
 Campus Box 8224
 4921 Parkview Place
 St. Louis, MO 63110
 USA

ROBERT D. ZWICKER, PhD
 Department of Radiation Oncology
 University of Kentucky Medical Center
 800 Rose Street
 Lexington, KY 40536
 USA

MEDICAL RADIOLOGY Diagnostic Imaging and Radiation Oncology

Titles in the series already published

RADIATION ONCOLOGY

Lung Cancer

Edited by C.W. Scarantino

Innovations in Radiation Oncology

Edited by H. R. Withers
and L. J. Peters

Radiation Therapy of Head and Neck Cancer

Edited by G. E. Laramore

Gastrointestinal Cancer – Radiation Therapy

Edited by R.R. Dobelbower, Jr.

Radiation Exposure and Occupational Risks

Edited by E. Scherer, C. Streffer,
and K.-R. Trott

Radiation Therapy of Benign Diseases A Clinical Guide

S. E. Order and S. S. Donaldson

Interventional Radiation Therapy Techniques – Brachytherapy

Edited by R. Sauer

Radiopathology of Organs and Tissues

Edited by E. Scherer, C. Streffer,
and K.-R. Trott

Concomitant Continuous Infusion Chemotherapy and Radiation

Edited by M. Rotman
and C. J. Rosenthal

Intraoperative Radiotherapy – Clinical Experiences and Results

Edited by F. A. Calvo, M. Santos,
and L.W. Brady

Radiotherapy of Intraocular and Orbital Tumors

Edited by W. E. Alberti and
R. H. Sagerman

Interstitial and Intracavitary Thermodiatherapy

Edited by M. H. Seegenschmiedt
and R. Sauer

Non-Disseminated Breast Cancer Controversial Issues in Management

Edited by G. H. Fletcher and
S.H. Levitt

Current Topics in Clinical Radiobiology of Tumors

Edited by H.-P. Beck-Bornholdt

Practical Approaches to Cancer Invasion and Metastases

A Compendium of Radiation
Oncologists' Responses to 40 Histories

Edited by A. R. Kagan with the
Assistance of R. J. Steckel

Radiation Therapy in Pediatric Oncology

Edited by J. R. Cassady

Radiation Therapy Physics

Edited by A. R. Smith

Late Sequelae in Oncology

Edited by J. Dunst and R. Sauer

Mediastinal Tumors. Update 1995

Edited by D. E. Wood
and C. R. Thomas, Jr.

Thermodiatherapy and Thermochemotherapy

Volume 1:
Biology, Physiology, and Physics

Volume 2:
Clinical Applications

Edited by M.H. Seegenschmiedt,
P. Fessenden, and C.C. Vernon

Carcinoma of the Prostate

Innovations in Management
Edited by Z. Petrovich, L. Baert,
and L.W. Brady

Radiation Oncology of Gynecological Cancers

Edited by H.W. Vahrson

Carcinoma of the Bladder

Innovations in Management
Edited by Z. Petrovich, L. Baert,
and L.W. Brady

Blood Perfusion and Microenvironment of Human Tumors Implications for Clinical Radiooncology

Edited by M. Molls and P. Vaupel

Radiation Therapy of Benign Diseases A Clinical Guide

2nd Revised Edition
S. E. Order and S. S. Donaldson

Carcinoma of the Kidney and Testis, and Rare Urologic Malignancies

Innovations in Management
Edited by Z. Petrovich, L. Baert,
and L.W. Brady

Progress and Perspectives in the Treatment of Lung Cancer

Edited by P. Van Houtte,
J. Klastersky, and P. Rocmans

Combined Modality Therapy of Central Nervous System Tumors

Edited by Z. Petrovich, L. W. Brady,
M. L. Apuzzo, and M. Bamberg

Age-Related Macular Degeneration Current Treatment Concepts

Edited by W. A. Alberti, G. Richard,
and R. H. Sagerman

Radiotherapy of Intraocular and Orbital Tumors

2nd Revised Edition
Edited by R. H. Sagerman,
and W. E. Alberti

Modification of Radiation Response Cytokines, Growth Factors, and Other Biological Targets

Edited by C. Nieder, L. Milas,
and K. K. Ang

Radiation Oncology for Cure and Palliation

R. G. Parker, N. A. Janjan,
and M. T. Selch

Clinical Target Volumes in Conformal and Intensity Modulated Radiation Therapy

A Clinical Guide to Cancer Treatment
Edited by V. Grégoire, P. Scalliet,
and K. K. Ang

Advances in Radiation Oncology in Lung Cancer

Edited by Branislav Jeremic

New Technologies in Radiation Oncology

Edited by W. Schlegel, T. Bortfeld,
and A.-L. Grosu

Technical Basis of Radiation Therapy Practical Clinical Applications

4th Revised Edition
Edited by S. H. Levitt, J. A. Purdy,
C. A. Perez, and S. Vijayakumar

Multimodal Concepts for Integration of Cytotoxic Drugs

Edited by J. M. Brown, M. P. Mehta,
and C. Nieder

MEDICAL RADIOLOGY Diagnostic Imaging and Radiation Oncology

Titles in the series already published

DIAGNOSTIC IMAGING

Innovations in Diagnostic Imaging

Edited by J. H. Anderson

Radiology of the Upper Urinary Tract

Edited by E. K. Lang

The Thymus - Diagnostic Imaging, Functions, and Pathologic Anatomy

Edited by E. Walter, E. Willich, and W. R. Webb

Interventional Neuroradiology

Edited by A. Valavanis

Radiology of the Pancreas

Edited by A. L. Baert, co-edited by G. Delorme

Radiology of the Lower Urinary Tract

Edited by E. K. Lang

Magnetic Resonance Angiography

Edited by I. P. Arlart, G. M. Bongartz, and G. Marchal

Contrast-Enhanced MRI of the Breast

S. Heywang-Köbrunner and R. Beck

Spiral CT of the Chest

Edited by M. Rémy-Jardin and J. Rémy

Radiological Diagnosis of Breast Diseases

Edited by M. Friedrich and E.A. Sickles

Radiology of the Trauma

Edited by M. Heller and A. Fink

Biliary Tract Radiology

Edited by P. Rossi, co-edited by M. Brezi

Radiological Imaging of Sports Injuries

Edited by C. Masciocchi

Modern Imaging of the Alimentary Tube

Edited by A. R. Margulis

Diagnosis and Therapy of Spinal Tumors

Edited by P. R. Algra, J. Valk, and J. J. Heimans

Interventional Magnetic Resonance Imaging

Edited by J.F. Debatin and G. Adam

Abdominal and Pelvic MRI

Edited by A. Heuck and M. Reiser

Orthopedic Imaging

Techniques and Applications

Edited by A. M. Davies and H. Pettersson

Radiology of the Female Pelvic Organs

Edited by E. K. Lang

Magnetic Resonance of the Heart and Great Vessels

Clinical Applications

Edited by J. Bogaert, A.J. Duerinckx, and F. E. Rademakers

Modern Head and Neck Imaging

Edited by S. K. Mukherji and J. A. Castelijns

Radiological Imaging of Endocrine Diseases

Edited by J. N. Bruneton in collaboration with B. Padovani and M.-Y. Mourou

Trends in Contrast Media

Edited by H. S. Thomsen, R. N. Muller, and R. F. Mattrey

Functional MRI

Edited by C. T. W. Moonen and P. A. Bandettini

Radiology of the Pancreas

2nd Revised Edition

Edited by A. L. Baert Co-edited by G. Delorme and L. Van Hoe

Emergency Pediatric Radiology

Edited by H. Carty

Spiral CT of the Abdomen

Edited by F. Terrier, M. Grossholz, and C. D. Becker

Liver Malignancies

Diagnostic and Interventional Radiology

Edited by C. Bartolozzi and R. Lencioni

Medical Imaging of the Spleen

Edited by A. M. De Schepper and F. Vanhoenacker

Radiology of Peripheral Vascular Diseases

Edited by E. Zeitler

Diagnostic Nuclear Medicine

Edited by C. Schiepers

Radiology of Blunt Trauma of the Chest

P. Schnyder and M. Wintermark

Portal Hypertension

Diagnostic Imaging-Guided Therapy

Edited by P. Rossi

Co-edited by P. Ricci and L. Broglia

Recent Advances in Diagnostic Neuroradiology

Edited by Ph. Demaerel

Virtual Endoscopy and Related 3D Techniques

Edited by P. Rogalla, J. Terwisscha Van Scheltinga, and B. Hamm

Multislice CT

Edited by M. F. Reiser, M. Takahashi, M. Modic, and R. Bruening

Pediatric Uroradiology

Edited by R. Fötter

Transfontanelar Doppler Imaging in Neonates

A. Couture and C. Veyrac

Radiology of AIDS

A Practical Approach

Edited by J.W.A.J. Reeders and P.C. Goodman

CT of the Peritoneum

Armando Rossi and Giorgio Rossi

Magnetic Resonance Angiography

2nd Revised Edition

Edited by I. P. Arlart, G. M. Bongratz, and G. Marchal

Pediatric Chest Imaging

Edited by Javier Lucaya and Janet L. Strife

Applications of Sonography in Head and Neck Pathology

Edited by J. N. Bruneton in collaboration with C. Raffaelli and O. Dassonville

Imaging of the Larynx

Edited by R. Hermans

3D Image Processing Techniques and Clinical Applications

Edited by D. Caramella and C. Bartolozzi

Imaging of Orbital and Visual Pathway Pathology

Edited by W. S. Müller-Forell

MEDICAL RADIOLOGY Diagnostic Imaging and Radiation Oncology

Titles in the series already published

Pediatric ENT Radiology

Edited by S. J. King
and A. E. Boothroyd

Radiological Imaging of the Small Intestine

Edited by N. C. Gourtsoyiannis

Imaging of the Knee

Techniques and Applications

Edited by A. M. Davies
and V. N. Cassar-Pullicino

Perinatal Imaging

From Ultrasound to MR Imaging

Edited by Fred E. Avni

Radiological Imaging of the Neonatal Chest

Edited by V. Donoghue

Diagnostic and Interventional Radiology in Liver Transplantation

Edited by E. Bücheler, V. Nicolas,
C. E. Broelsch, X. Rogiers,
and G. Krupski

Radiology of Osteoporosis

Edited by S. Grampp

Imaging Pelvic Floor Disorders

Edited by C. I. Bartram
and J. O. L. DeLancey
Associate Editors: S. Halligan,
F. M. Kelvin, and J. Stoker

Imaging of the Pancreas

Cystic and Rare Tumors
Edited by C. Procacci
and A. J. Megibow

High Resolution Sonography of the Peripheral Nervous System

Edited by S. Peer and G. Bodner

Imaging of the Foot and Ankle Techniques and Applications

Edited by A. M. Davies,
R. W. Whitehouse,
and J. P. R. Jenkins

Radiology Imaging of the Ureter

Edited by F. Joffe, Ph. Otal,
and M. Soulie

Imaging of the Shoulder

Techniques and Applications
Edited by A. M. Davies and J. Hodler

Radiology of the Petrous Bone

Edited by M. Lemmerling
and S. S. Kollias

Interventional Radiology in Cancer

Edited by A. Adam, R. F. Dondelinger,
and P. R. Mueller

Duplex and Color Doppler Imaging of the Venous System

Edited by G. H. Mostbeck

Multidetector-Row CT of the Thorax

Edited by U. J. Schoepf

Functional Imaging of the Chest

Edited by H.-U. Kauczor

Radiology of the Pharynx and the Esophagus

Edited by O. Ekberg

Radiological Imaging in Hematological Malignancies

Edited by A. Guermazi

Imaging and Intervention in Abdominal Trauma

Edited by R. F. Dondelinger

Multislice CT

2nd Revised Edition
Edited by M. F. Reiser, M. Takahashi,
M. Modic, and C. R. Becker

Intracranial Vascular Malformations and Aneurysms

**From Diagnostic Work-Up
to Endovascular Therapy**
Edited by M. Forsting

Radiology and Imaging of the Colon

Edited by A. H. Chapman

Coronary Radiology

Edited by M. Oudkerk

Dynamic Contrast-Enhanced Magnetic Resonance Imaging in Oncology

Edited by A. Jackson, D. L. Buckley,
and G. J. M. Parker

Imaging in Treatment Planning for Sinonasal Diseases

Edited by R. Maroldi and P. Nicolai

Clinical Cardiac MRI

With Interactive CD-ROM

Edited by J. Bogaert,
S. Dymarkowski, and A. M. Taylor

Focal Liver Lesions

**Detection, Characterization,
Ablation**

Edited by R. Lencioni, D. Cioni,
and C. Bartolozzi

Multidetector-Row CT Angiography

Edited by C. Catalano
and R. Passariello

Paediatric Musculoskeletal Diseases With an Emphasis on Ultrasound

Edited by D. Wilson

Contrast Media in Ultrasonography Basic Principles and Clinical Applications

Edited by Emilio Quaia

MR Imaging in White Matter Diseases of the Brain and Spinal Cord

Edited by M. Filippi, N. De Stefano,
V. Dousset, and J. C. McGowan

Diagnostic Nuclear Medicine

2nd Revised Edition

Edited by C. Schiepers

Imaging of the Kidney Cancer

Edited by A. Guermazi

Magnetic Resonance Imaging in Ischemic Stroke

Edited by R. von Kummer and T. Back

Imaging of the Hip & Bony Pelvis

Techniques and Applications
Edited by A. M. Davies, K. J. Johnson,
and R. W. Whitehouse

Imaging of Occupational and Environmental Disorders of the Chest

Edited by P. A. Gevenois and
P. De Vuyst

Contrast Media

Safety Issues and ESUR Guidelines
Edited by H. S. Thomsen

Virtual Colonoscopy

A Practical Guide
Edited by P. Lefere and S. Gryspeerdt

Vascular Embolotherapy

A Comprehensive Approach

Volume 1

Edited by J. Golzarian. Co-edited by
S. Sun and M. J. Sharafuddin

Vascular Embolotherapy

A Comprehensive Approach

Volume 2

Edited by J. Golzarian. Co-edited by
S. Sun and M. J. Sharafuddin

