

Contents

Authors	xix
Preface	xxix
Milestone 25th Silver Anniversary Edition	xxxii

1. Advancing the Quality & Safety of Care 1

Daniel Hyman, MD

Introduction	1
Current Context	1
Strategies & Models for Quality Improvement (QI)	4
Principles of Patient Safety (Incident Reporting, Just Culture, Disclosure, FMEA, RCA, Reliability, Data, & Checklists)	7

2. The Newborn Infant 10

Danielle Smith, MD

Introduction	10
The Neonatal History	10
Assessment of Growth & Gestational Age	10
Examination at Birth	12
Examination in the Nursery	12
Care of the Well Neonate	15
Feeding the Well Neonate	15
Early Discharge of the Newborn Infant	16
Hearing Screening	17
Common Problems in the Term Newborn	18
Neonatal Jaundice	18
Hypoglycemia	24
Respiratory Distress in the Term Newborn	
Infant	26
Heart Murmurs	28
Birth Trauma	28
Infants of Mothers Who Abuse Drugs	29
Multiple Births	31
Neonatal Intensive Care	31
Perinatal Resuscitation	31
The Preterm Infant	35
The Late Preterm Infant	44
Cardiac Problems in the Newborn Infant	45
Structural Heart Disease	45
Persistent Pulmonary Hypertension	46
Arrhythmias	47
Gastrointestinal & Abdominal Surgical	
Conditions in the Newborn Infant	47
Esophageal Atresia & Tracheoesophageal Fistula	47
Intestinal Obstruction	48

Abdominal Wall Defects	49
Diaphragmatic Hernia	50
Gastrointestinal Bleeding	50
Gastroesophageal Reflux	51
Infections in the Newborn Infant	51
Bacterial Infections	51
Fungal Sepsis	54
Congenital Infections	55
Perinatally Acquired Infections	57
Hematologic Disorders in the Newborn Infant	58
Bleeding Disorders	58
Anemia	60
Polycythemia	60
Renal Disorders in the Newborn Infant	61
Renal Failure	61
Urinary Tract Anomalies	61
Renal Vein Thrombosis	62
Neurologic Problems in the Newborn Infant	62
Seizures	62
Intracranial Hemorrhage	63
Metabolic Disorders in the Newborn Infant	64
Hyperglycemia	64
Hypocalcemia	64
Inborn Errors of Metabolism	65
Quality Assessment & Improvement in the Newborn Nursery & NICU	65

3. Child Development & Behavior 66

Edward Goldson, MD

Ann Reynolds, MD

Abigail S. Angulo, MD, MPH

Dannah M. Raz, MD

Introduction	66
Normal Development	66
The First 2 Years	66
Ages 2–4 Years	72
Early School Years: Ages 5–7 Years	72
Middle Childhood: Ages 7–11 Years	73
Behavioral & Developmental Variations	73
Normality & Temperament	73
Enuresis & Encopresis	74
Enuresis	74
Encopresis	75
Common Developmental Concerns	76
Colic	76
Feeding Disorders in Infants & Young Children	77
Sleep Disorders	79

8. Child Abuse & Neglect 208

Antonia Chiesa, MD
Andrew P. Sirotnak, MD, FAAP

Introduction	208
Prevention	209
Clinical Findings	210
Differential Diagnosis	215
Treatment	215
Prognosis	216

9. Ambulatory & Office Pediatrics 217

Meghan Treitz, MD
Daniel Nicklas, MD
David Fox, MD

Introduction	217
Pediatric History	217
Pediatric Physical Examination	218
Health Supervision Visits	219
Developmental & Behavioral Assessment	219
Growth Parameters	222
Blood Pressure	223
Vision & Hearing Screening	224
Anticipatory Guidance	228
Nutrition Counseling	230
Counseling About Television & Other Media	230
Immunizations	231
Acute-Care Visits	232
Prenatal Visits	232
Sports Physicals	232
Chronic Disease Management	233
Medical Home	233
Mental & Behavioral Health	233
Telephone Management & Web-Based Information	234
Advocacy & Community Pediatrics	235
Toxic Stress	235
Common General Pediatric Issues	236
Fever	236
Growth Deficiency	237

10. Immunization 240

Matthew F. Daley, MD
Sean T. O'leary, MD, MPH
Ann-Christine Nyquist, MD, MSPH
Jessica R. Cataldi, MD, MSCS

Standards for Pediatric Immunization Practices	241
Routine Childhood & Adolescent Immunization Schedules	242
Vaccine Safety	242
Vaccination in Special Circumstances	250

Communicating with Parents About Vaccines	251
Hepatitis B Vaccination	252
Rotavirus Vaccination	254
Diphtheria-Tetanus-Acellular Pertussis Vaccination	255
<i>Haemophilus Influenzae</i> Type B Vaccination	257
Pneumococcal Vaccination	258
Poliomyelitis Vaccination	260
Influenza Vaccination	261
Measles, Mumps, & Rubella Vaccination	262
Varicella Vaccination	265
Hepatitis A Vaccination	266
Meningococcal Vaccination	267
Tetanus-Reduced Diphtheria-Acellular Pertussis Vaccination (Adolescents & Adults)	269
Human Papillomavirus Vaccination	270
Vaccinations for Special Situations	271
Rabies Vaccination	271
Typhoid Fever Vaccination	272
Cholera Vaccination	273
Japanese Encephalitis Vaccination	273
Tuberculosis Vaccination	273
Yellow Fever Vaccination	274
Passive Prophylaxis	274

11. Normal Childhood Nutrition & Its Disorders 276

Matthew A. Haemer, MD, MPH
Liliane K. Diab, MD
Laura E. Primak, RD, CNSD, CSP
Nancy F. Krebs, MD, MS

Nutritional Requirements	276
Nutrition & Growth	276
Energy	276
Protein	277
Lipids	278
Carbohydrates	279
Major Minerals	280
Trace Elements	280
Vitamins	280
Infant Feeding	284
Breast-Feeding	284
Special Dietary Products for Infants	291
Nutrition for Children 2 Years & Older	292
Pediatric Undernutrition	292
Pediatric Overweight & Obesity	294
Nutrition Support	297
Enteral	297
Parenteral Nutrition	298
Nutrient Requirements & Delivery	299

12. Emergencies & Injuries 305

<i>Jonathan Orsborn, MD</i>	
<i>Cortney Braund, MD</i>	
Introduction to Pediatric Emergencies & Injuries	305
Initial Approach to the Acutely Ill Infant or Child	305
The ABCs of Resuscitation	306
Management of Shock	310
Summary of Initial Approach to the Acutely Ill Infant or Child	311
Emergency Pediatric Drugs	311
Approach to the Pediatric Trauma Patient	312
Mechanism of Injury	312
Initial Assessment & Management	312
Primary Survey	313
Secondary Survey	315
Head Injury	317
Burns	319
Thermal Burns	319
Electrical Burns	321
Disorders Due to Extremes of Environment	321
Heat-Related Illnesses & Heat Stroke	321
Hypothermia	322
Submersion Injuries	323
Lacerations	324
Animal & Human Bites	325
Dog Bites	325
Cat Bites	326
Human Bites	326
Pain Management & Procedural Sedation	326

13. Poisoning 328

<i>George Sam Wang, MD</i>	
<i>Barry H. Rumack, MD</i>	
<i>Richard C. Dart, MD, PhD</i>	
Introduction	328
Pharmacologic Principles of Toxicology	328
Preventing Childhood Poisonings	329
General Treatment of Poisoning	329
Initial Telephone Contact	329
Initial Emergency Department Contact	332
Definitive Therapy of Poisoning	332
Management of Specific Common Poisonings	333
Acetaminophen (Paracetamol)	333
Alcohol, Ethyl (Ethanol)	335
Amphetamines & Related Drugs (Stimulants, Methamphetamine, 3,4-Methylenedioxy-N-Methylamphetamine)	336

Anesthetics, Local	336
Antihistamines & Cough & Cold Preparations	337
Barbiturates & Benzodiazepines	338
Belladonna Alkaloids (Atropine, Jimsonweed, Potato Leaves, Scopolamine, Stramonium)	338
β -Blockers & Calcium Channel Blockers	338
Carbon Monoxide	339
Caustics	339
Central α_2 -Adrenergic Agonist	340
Cocaine	340
Cosmetics & Related Products	341
Cyclic Antidepressants	341
Digitalis & Other Cardiac Glycosides	341
Diphenoxylate with Atropine (Lomotil) & Loperamide (Imodium)	342
Disinfectants & Deodorizers	342
Disk-Shaped "Button" Batteries	343
Ethylene Glycol & Methanol	343
γ -Hydroxybutyrate, γ -Butyrolactone, Butanediol, Flunitrazepam, & Ketamine	344
Hydrocarbons (Benzene, Charcoal Lighter Fluid, Gasoline, Kerosene, Petroleum Distillates, Turpentine)	344
Ibuprofen	344
Insect Stings (Bee, Wasp, & Hornet)	345
Insecticides	345
Iron	346
Lead	346
Magnets	347
Marijuana	347
Mushrooms	348
Nitrites, Nitrates, Aniline, Pentachlorophenol, & Dinitrophenol	348
Opioids & Opiates	349
Oral Anti-Diabetics (Sulfonylureas, Metformin)	349
Antipsychotics (Typical & Atypical)	350
Plants	350
Psychotropic Drugs	351
Salicylates	352
Scorpion Stings	353
Serotonin Reuptake Inhibitors	353
Snakebite	353
Soaps & Detergents	354
Spider Bites	355
Vitamins	355
Warfarin (Coumadin) & Newer Oral Anticoagulants (NOAC)	356

14. Critical Care 357

<i>Amy C. Clevenger, MD, PhD</i>	
<i>Angela S. Czaja, MD, MSC</i>	
<i>Ryan J. Good, MD</i>	
<i>Cameron F. Gunville, DO</i>	
<i>Leslie A. Ridall, DO</i>	
<i>Todd C. Carpenter, MD</i>	
<i>Eva N. Grayck, MD</i>	
<i>Carleen Schneider, MD</i>	
Introduction	357
Respiratory Critical Care	357
Acute Respiratory Failure	357
Conventional Mechanical Ventilation	361
Other Modes of Respiratory Support	363
Major Respiratory Diseases in the Pediatric ICU	364
Acute Respiratory Distress Syndrome	364
Status Asthmaticus	368
Cardiovascular Critical Care	370
Shock	370
Sepsis	373
Neurocritical Care	377
Traumatic Brain Injury	377
Hypoxic-Ischemic Encephalopathy	380
Status Epilepticus	381
Acute Kidney Injury & Renal Replacement Therapy	382
Fluid Management & Nutritional Support of the Critically Ill Child	383
Sedation & Analgesia in the Pediatric ICU	386
End-of-Life Care & Death in the PICU	389
Quality Improvement Initiatives in the PICU	392

15. Skin 393

<i>Lori D. Prok, MD</i>	
<i>Carla X. Torres-Zegarra, MD</i>	
General Principles	393
Diagnosis of Skin Disorders	393
Treatment of Skin Disorders	393
Disorders of the Skin in Newborns	395
Transient Diseases in Newborns	395
Pigment Cell Birthmarks, Nevi, & Melanoma	396
Melanocytic Nevi	396
Vascular Birthmarks	397
Epidermal Birthmarks	398
Connective Tissue Birthmarks (Juvenile Elastoma, Collagenoma)	399
Hereditary Skin Disorders	399
Common Skin Diseases in Infants, Children, & Adolescents	399

Acne	399
Bacterial Infections of the Skin	402
Fungal Infections of the Skin	403
Viral Infections of the Skin	404
Virus-Induced Tumors	405
Insect Infestations	406
Dermatitis (Eczema)	406
Common Skin Tumors	409
Papulosquamous Eruptions	410
Hair Loss (Alopecia)	411
Reactive Erythemas	412
Miscellaneous Skin Disorders Seen in Pediatric Practice	413

16. Eye 414

<i>Jennifer Lee Jung, MD</i>	
Introduction	414
Common Nonspecific Signs & Symptoms	414
Red Eye	414
Tearing	414
Discharge	414
Pain & Foreign-Body Sensation	414
Photophobia	414
Abnormal Red Reflex	414
Refractive Errors	415
Myopia (Nearsightedness)	416
Hyperopia (Farsightedness)	416
Astigmatism	416
Ophthalmic Examination	416
History	416
Visual Acuity	416
External Examination	417
Pupils	418
Alignment & Motility Evaluation	418
Ophthalmoscopic Examination	419
Ocular Trauma	420
Prevention of Ocular Injuries	420
Corneal Abrasion	420
Ocular Foreign Bodies	420
Intraocular Foreign Bodies & Perforating Ocular Injuries	421
Blunt Orbital Trauma	422
Lacerations	423
Burns	423
Hyphema	424
Abusive Head Trauma & Nonaccidental Trauma	425
Disorders of the Ocular Structures	425
Diseases of the Eyelids	425
Viral Eyelid Disease	428
Miscellaneous Eyelid Infections	428
Eyelid Ptosis	428

Horner Syndrome	429
Eyelid Tics	430
Disorders of the Nasolacrimal System	430
Nasolacrimal Duct Obstruction	430
Congenital Dacryocystocele	431
Dacryocystitis	431
Diseases of the Conjunctiva	432
Ophthalmia Neonatorum	432
Bacterial Conjunctivitis	433
Viral Conjunctivitis	434
Allergic Conjunctivitis	435
Mucocutaneous Diseases	435
Disorders of the Iris	437
Iris Coloboma	437
Aniridia	437
Albinism	438
Miscellaneous Iris Conditions	438
Glaucoma	439
Uveitis	439
Anterior Uveitis/Iridocyclitis/Iritis	439
Posterior Uveitis	440
Intermediate Uveitis	441
Disorders of the Cornea	442
Cloudy Cornea	442
Viral Keratitis	442
Corneal Ulcers	443
Disorders of the Lens	443
Cataracts	444
Dislocated Lenses/Ectopia Lentis	444
Disorders of the Retina	445
Retinal Hemorrhages in the Newborn	445
Retinopathy of Prematurity (ROP)	445
Retinoblastoma	446
Retinal Detachment	447
Diabetic Retinopathy	447
Diseases of the Optic Nerve	448
Optic Neuropathy	448
Optic Nerve Hypoplasia	448
Papilledema	449
Optic Neuritis	450
Optic Atrophy	451
Diseases of the Orbit	452
Periorbital & Orbital Cellulitis	452
Craniofacial Anomalies	452
Orbital Tumors	453
Nystagmus	453
Amblyopia	454
Strabismus	455
Esotropia (Crossed Eyes)	455
Exotropia (Wall-Eyed, Drifting of Eyes)	456
Unexplained Decreased Vision in	
Infants & Children	457
Learning Disabilities & Dyslexia	458

17. Oral Medicine & Dentistry 459

<i>Roopa P. Gandhi, BDS, MSD</i>	
<i>Chaitanya P. Puranik, BDS, MS, MDentSci, PhD</i>	
<i>Anne Wilson, DDS, MS</i>	
<i>Katherine L. Chin, DDS, MS</i>	
Pediatric Oral Health	459
Oral Examination of Children	460
Dental Caries	463
Periodontal Disease	466
Dental Emergencies	466
Special Patient Populations	469
Orthodontic Referral	470

18. Ear, Nose, & Throat 471

<i>Patricia J. Yoon, MD</i>	
<i>Melissa A. Scholes, MD</i>	
<i>Brian W. Herrmann, MD</i>	
The Ear	471
Infections of the Ear	471
Acute Trauma to the Middle Ear	480
Ear Canal Foreign Body & Cerumen Impaction	481
Auricular Hematoma	481
Congenital Ear Malformations Identification & Management of Hearing Loss	481
The Nose & Paranasal Sinuses	484
Acute Viral Rhinitis	484
Rhinosinusitis	486
Choanal Atresia	488
Recurrent Rhinitis	488
Epistaxis	488
Nasal Infection	489
Nasal Trauma	489
Foreign Bodies in the Nose	489
The Throat & Oral Cavity	490
Acute Stomatitis	490
Pharyngitis	490
Peritonsillar Cellulitis or Abscess (Quinsy)	493
Retropharyngeal Abscess	494
Ludwig Angina	494
Acute Cervical Adenitis	494
Tonsillectomy & Adenoidectomy	495
Disorders of the Lips	496
Disorders of the Tongue	496
Halitosis	497
Salivary Gland Disorders	497
Congenital Oral Malformations	497

19. Respiratory Tract & Mediastinum 499

<i>Monica J. Federico, MD</i>	
<i>Christopher D. Baker, MD</i>	
<i>Emily M. DeBoer, MD</i>	
<i>Oren Kupfer, MD</i>	
<i>Stacey L. Martiniano, MD</i>	
<i>Paul Stillwell, MD</i>	
<i>Stephen Hawkins, MD</i>	
<i>Deborah Liptzin, MD</i>	
Respiratory Tract	499
Growth & Development	499
Diagnostic Aids	499
Physical Examination of the Respiratory Tract	499
Pulmonary Function Tests	500
Assessment of Oxygenation & Ventilation	501
Diagnosis of Respiratory Tract Infections	502
Imaging of the Respiratory Tract	504
Laryngoscopy & Bronchoscopy	504
General Therapy for Pediatric	
Lung Diseases	504
Oxygen Therapy	504
Inhalation of Medications	505
Airway Clearance Therapy	506
Avoidance of Environmental Hazards	506
Disorders of the Conducting Airways	506
Laryngomalacia & Congenital Disorders of the	
Extrathoracic Airway	507
Laryngomalacia	507
Other Causes of Congenital Extrathoracic	
Obstruction	507
Acquired Disorders of the Extrathoracic	
Airway	508
Foreign-Body Aspiration in the Extrathoracic	
Airway	508
Croup Syndromes	509
Vocal Fold Immobility	511
Subglottic Stenosis	511
Congenital Causes of Intrathoracic Airway	
Obstruction	512
Malacia of Airways	512
Vascular Rings & Slings	512
Bronchogenic Cysts	513
Acquired Causes of Intrathoracic Airway	
Obstruction	513
Foreign-Body Aspiration in the Intrathoracic	
Airway	514
Disorders of Mucociliary Clearance	514
Cystic Fibrosis	514
Primary Ciliary Dyskinesia	516
Bronchiectasis	517
Congenital Malformations of the Lung	
Parenchyma	518

Pulmonary Agenesis & Hypoplasia	518
Pulmonary Sequestration	519
Congenital Lobar Overinflation	519
Congenital Pulmonary Airway Malformation (Previously Named Cystic Adenomatoid Malformation)	520
Acquired Abnormalities of the	
Lung Parenchyma	521
Bronchopulmonary Dysplasia	521
Community-Acquired Bacterial Pneumonia	523
Parapneumonic Effusion & Empyema	525
Atypical Pneumonias	526
Viral Pneumonia	526
Bronchiolitis	527
Mycoplasma Pneumonia	528
Aspiration Pneumonia	528
Pneumonia in the	
Immunocompromised Host	529
Lung Abscess	531
Bronchiolitis Obliterans	532
Children's Interstitial Lung Disease	
Syndrome	533
Hypersensitivity Pneumonitis	535
Diseases of the Pulmonary Circulation	535
Pulmonary Hemorrhage	535
Pulmonary Embolism	537
Pulmonary Edema	538
Congenital Pulmonary Lymphangiectasia	539
Disorders of the Chest Wall	539
Scoliosis	539
Pectus Carinatum	539
Pectus Excavatum	540
Neuromuscular Disorders &	
Lung Disease	540
Disorders of the Pleura &	
Pleural Cavity	540
Hemothorax	541
Chylothorax	541
Pneumothorax & Related Air Leak	
Syndromes	542
Mediastinum	542
Mediastinal Masses	542
Sleep-Disordered Breathing	543
Primary Snoring & Obstructive	
Sleep Apnea	544
Periodic Breathing & Central	
Sleep Apnea	546
Brief Resolved Unexplained Events (Formerly	
Apparent Life-Threatening Events)	546
Sudden Unexpected Infant Death &	
Sudden Infant Death Syndrome	549
Quality Assessment & Outcomes Metrics	550

20. Cardiovascular Diseases 551*Pei-Ni Jone, MD**John S. Kim, MD**Johannes von Alvensleben, MD**Dale Burkett, MD*

Introduction	551
Diagnostic Evaluation	551
History	551
Physical Examination	551
Electrocardiography	554
Chest Radiograph	556
Echocardiography	557
Magnetic Resonance Imaging	558
Cardiopulmonary Stress Testing	558
Arterial Blood Gases & Pulse Oximetry	558
Cardiac Catheterization & Angiocardiology	559
Perinatal & Neonatal Circulation	560
Heart Failure	561
Genetic Basis of Congenital Heart Disease	563
Acyanotic Congenital Heart Disease	564
Defects in Septation	564
Patent (Persistent) Ductus Arteriosus	568
Right-Sided Obstructive Lesions	569
Left-Sided Lesions	572
Diseases of the Aorta	576
Coronary Artery Abnormalities	577
Cyanotic Congenital Heart Disease	578
Tetralogy of Fallot	578
Pulmonary Atresia with Ventricular Septal Defect	580
Pulmonary Atresia with Intact Ventricular Septum	580
Tricuspid Atresia	581
Hypoplastic Left Heart Syndrome	582
Transposition of the Great Arteries	584
Total Anomalous Pulmonary Venous Return	585
Truncus Arteriosus	587
Quality Improvement in Congenital Heart Disease	588
Acquired Heart Disease	588
Rheumatic Fever	588
Kawasaki Disease	590
Infective Endocarditis	591
Pericarditis	593
Cardiomyopathy	594
Myocarditis	597
Preventive Cardiology	598
Hypertension	598
Atherosclerosis & Dyslipidemias	598
Chest Pain	599
Cardiac Transplantation	600

Quality Improvement for Pediatric Heart

Transplantation

601

Pulmonary Hypertension

602

Disorders of Rate & Rhythm

603

Disorders of the Sinus Node

603

Premature Beats

604

Supraventricular Tachycardia

605

Ventricular Tachycardia

609

Long QT Syndrome

609

Sudden Cardiac Death

610

Disorders of Atrioventricular Conduction

610

Syncope (Fainting)

612

Introduction

612

Diagnostic Evaluation

612

Vasovagal/Neurocardiogenic Syncope

613

21. Gastrointestinal Tract 615*David Brumbaugh, MD**Glenn T. Furuta, MD**Edward J. Hoffenberg, MD**Gregory E. Kobak, MD**Robert E. Kramer, MD**Seth Septer, MD**Mary Shull, MD**Jason Soden, MD**Thomas Walker, MD*

Disorders of the Esophagus	615
Gastroesophageal Reflux & GERD	615
Eosinophilic Esophagitis	617
Achalasia of the Esophagus	618
Caustic Burns of the Esophagus	619
Foreign Bodies in the Alimentary Tract	620
Disorders of the Stomach & Duodenum	621
Hiatal & Paraesophageal Hernia	621
Pyloric Stenosis	622
Gastric & Duodenal Ulcer	623
Congenital Diaphragmatic Hernia	624
Congenital Duodenal Obstruction	624
Disorders of the Small Intestine	625
Intestinal Atresia & Stenosis	625
Intestinal Malrotation	626
Short Bowel Syndrome	627
Intussusception	628
Inguinal Hernia	629
Umbilical Hernia	629
Patent Omphalomesenteric Duct	630
Meckel Diverticulum	630
Acute Appendicitis	630
Duplications of the Gastrointestinal Tract	631
Disorders of the Colon	631

Congenital Aganglionic Megacolon (Hirschsprung Disease)	631
Constipation	633
Anal Fissure	634
Congenital Anorectal Anomalies	634
<i>Clostridium Difficile</i> Infection in Children	635
Disorders of the Peritoneal Cavity	636
Peritonitis	636
Chylous Ascites	637
Gastrointestinal Tumors & Malignancies	637
Juvenile Polyps	637
Cancers of the Esophagus, Small Bowel, & Colon	638
Mesenteric Cysts	638
Intestinal Hemangiomas & Vascular Malformations	639
Major Gastrointestinal Symptoms & Signs	640
Acute Diarrhea	640
Chronic Diarrhea	641
Gastrointestinal Bleeding	643
Vomiting	646
Abdominal Pain	647
Acute Abdomen	649
Malabsorption Syndromes	649
Inflammatory Bowel Disease	653

22. Liver & Pancreas 657

<i>Ronald J. Sokol, MD</i>	
<i>Michael R. Narkewicz, MD</i>	
<i>Jacob A. Mark, MD</i>	
<i>Cara L. Mack, MD</i>	
<i>Amy G. Feldman, MD, MSCS</i>	
<i>Shikha S. Sundaram, MD, MSCl</i>	
Liver Disorders	657
Neonatal Cholestatic Jaundice	657
Intrahepatic Cholestasis	657
Extrahepatic Neonatal Cholestasis	666
Other Neonatal Hyperbilirubinemic Conditions (Noncholestatic Nonhemolytic)	668
Hepatitis A	671
Hepatitis B	673
Hepatitis C	674
Hepatitis D (Delta Agent)	676
Hepatitis E	676
Other Hepatitis Viruses	676
Acute Liver Failure	676
Autoimmune Hepatitis	678
Nonalcoholic Fatty Liver Disease	679
α_1 -Antitrypsin Deficiency Liver Disease	680

Wilson Disease (Hepatolenticular Degeneration)	682
Drug-Induced Liver Diseases	683
Cirrhosis	684
Portal Hypertension	685
Biliary Tract Disease	688
Pyogenic & Amebic Liver Abscess	693
Liver Tumors	694
Liver Transplantation	695
Pancreatic Disorders	696
Acute Pancreatitis	696
Chronic Pancreatitis	697
Gastrointestinal & Hepatobiliary Manifestations of Cystic Fibrosis	698
Syndromes with Pancreatic Exocrine Insufficiency	701
Isolated Exocrine Pancreatic Enzyme Defect	701
Pancreatic Tumors	702
References	703

23. Fluid, Electrolyte, & Acid-Base Disorders & Therapy 704

<i>Melisha G. Hanna, MD, MS</i>	
<i>Margret E. Bock, MD, MS</i>	
Regulation of Body Fluids, Electrolytes, & Tonicity	704
Acid-Base Balance	705
Fluid & Electrolyte Management	706
Dehydration	707
Hyponatremia	709
Hypernatremia	710
Potassium Disorders	710
Acid-Base Disturbances	712
Metabolic Acidosis	712
Metabolic Alkalosis	712
Respiratory Acidosis	713
Respiratory Alkalosis	713

24. Kidney & Urinary Tract 714

<i>Margret E. Bock, MD, MS</i>	
<i>Melisha G. Hanna, MD, MS</i>	
Evaluation of the Kidney & Urinary Tract	714
History	714
Physical Examination	714
Laboratory Evaluation of Renal Function	714
Laboratory Evaluation of Immunologic Function	718

Radiographic Evaluation	718	Seizures & Epilepsy	748
Renal Biopsy	718	Sleep Disorders	760
Congenital Anomalies of the Urinary Tract	718	Headaches	761
Renal Parenchymal Anomalies	718	Pseudotumor Cerebri (Idiopathic Intracranial Hypertension)	764
Distal Urinary Tract Anomalies	720	Cerebrovascular Disease	766
Hematuria & Glomerular Disease	720	Congenital Malformations of the Nervous System	769
Microhematuria	720	Abnormal Head Size	772
Glomerulonephritis	721	Neurocutaneous Dysplasias	774
Tubulointerstitial Disease	722	Central Nervous System Degenerative Disorders of Infancy & Childhood	780
Acute Interstitial Nephritis	722	Ataxias of Childhood	780
Proteinuria & Renal Disease	723	Acute Ataxias of Childhood	780
Congenital Nephrosis (Finnish Type)	723	Chronic & Episodic Ataxias	783
Idiopathic Nephrotic Syndrome of Childhood	723	Movement Disorders	783
Focal Segmental Glomerulosclerosis	724	Cerebral Palsy	786
Membranous Nephropathy (Membranous Glomerulonephritis)	724	Infections & Inflammatory Disorders of the Central Nervous System	787
Diseases of the Renal Vessels	725	Bacterial Meningitis	788
Renal Vein Thrombosis	725	Brain Abscess	789
Renal Arterial Disease	725	Viral Infections	790
Hemolytic-Uremic Syndrome	725	Encephalopathy of Human Immunodeficiency Virus Infection	790
Renal Failure	726	Other Infections	790
Acute Kidney Injury	726	Noninfectious Inflammatory Disorders of the Central Nervous System	790
Chronic Renal Failure	729	Syndromes Presenting as Acute Flaccid Weakness	792
Hypertension	730	Disorders of Childhood Affecting Muscles	796
Inherited or Developmental Defects of the Kidneys	733	Benign Acute Childhood Myositis	802
Disorders of the Renal Tubules	733	Disorders of Neuromuscular Transmission	802
Cystinosis	735	Lesions of the Peripheral Nerve	805
Oculocerebrorenal Syndrome (Lowe Syndrome)	735	Peripheral Neuropathy	806
Hypokalemic Alkalosis (Bartter Syndrome, Gitelman Syndrome, & Liddle Syndrome)	735	Motor Neuron Disorders	807
Nephrogenic Diabetes Insipidus	736	Miscellaneous Neuromuscular Disorders	808
Nephrolithiasis	736	Floppy Infant Syndrome	808
Urinary Tract Infections	737		
QA/QI in Pediatric Nephrology	739		

25. Neurologic & Muscular Disorders 740

<i>Ricka Messer, MD, PhD</i>	
<i>Teri L. Schreiner, MD, MPH</i>	
<i>Diana Walleigh, MD</i>	
<i>Michele L. Yang, MD</i>	
<i>Jan A. Martin, MD</i>	
<i>Scott Demarest, MD</i>	
Neurologic Assessment & Neurodiagnostics	740
History & Examination	740
Diagnostic Testing	740
Pediatric Neuroradiologic Procedures	742
Disorders Affecting the Nervous System in Infants & Children	746
Altered States of Consciousness (Coma)	746

26. Orthopedics 811

<i>Jason T. Rhodes, MD, MS</i>	
<i>Alex Tagawa, BS</i>	
<i>Cameron Niswander, BA</i>	
<i>Wade Coomer, BS</i>	
<i>Mark A. Erickson, MD, MMM</i>	
<i>Sayan De, MD</i>	
Introduction	811
Disturbances of Prenatal Origin	811
Congenital Amputations & Limb Deficiencies	811
Deformities of the Extremities	812
Common Foot Problems	812
Genu Varum & Genu Valgum	814

Tibial Torsion & Femoral Anteversion	815
Developmental Dysplasia of the Hip Joint	815
Slipped Capital Femoral Epiphysis	817
Common Spine Conditions	818
Back Pain	818
Torticollis	818
Scoliosis	819
Kyphosis	820
Inflammatory Conditions	821
Syndromes with Musculoskeletal Involvement	821
Arthrogryposis Multiplex Congenita (Amyoplasia Congenita)	821
Neurologic Disorders Involving the Musculoskeletal System	823
Trauma	824
Traumatic Subluxations & Dislocations	825
Fractures	826
Infections of the Bones & Joints	828
Vascular Lesions & Avascular Necrosis (Osteochondroses)	831
Neoplasia of the Musculoskeletal System	833
Miscellaneous Diseases of Bone & Joint	834
Fibrous Dysplasia	835
Bone Cysts, Baker Cyst, & Ganglions	835
Quality Assurance/Improvement Initiatives in Orthopedics	836
27. Sports Medicine	837
<i>Katherine S. Dahab, MD, FAAP, CAQSM</i>	
<i>Stephanie W. Mayer, MD</i>	
<i>Kyle B. Nagle, MD, MPH, FAAP, CAQSM</i>	
<i>Armando Vidal, MD</i>	
Basic Principles	837
Fitness & Conditioning	837
Sports Nutrition	838
Preparticipation Physical Evaluation	838
Rehabilitation of Sports Injuries	845
Common Sports Medicine Issues & Injuries	846
Infectious Diseases	846
Head & Neck Injuries	847
Spine Injuries	850
Shoulder Injuries	851
Elbow Injuries	853
Hand & Wrist Injuries	855
Hip Injuries	857
Knee Injuries	859
Foot & Ankle Injuries	863
Prevention	864

28. Rehabilitation Medicine 866

Pamela E. Wilson, MD
Gerald H. Clayton, PhD

Pediatric Brain Injury	866
Spinal Cord Injury	869
Brachial Plexus Lesions & Typical Features	871
Common Rehabilitation Problems	872
Quality Assurance/Improvement Initiatives in Rehabilitation Medicine	874

29. Rheumatic Diseases 875

Jennifer B. Soep, MD

Juvenile Idiopathic Arthritis	875
Systemic Lupus Erythematosus	878
Dermatomyositis	880
Vasculitis	881
Raynaud Phenomenon	882
Noninflammatory Pain Syndromes	882

30. Hematologic Disorders 884

Michael Wang, MD
Christopher McKinney, MD
Rachelle Nuss, MD
Daniel R. Ambruso, MD

Normal Hematologic Values	884
Bone Marrow Failure	884
Constitutional Aplastic Anemia (Fanconi Anemia)	884
Acquired Aplastic Anemia	886
Anemias	887
Approach to the Child with Anemia	887
Pure Red Cell Aplasia	888
Nutritional Anemias	890
Anemia of Chronic Disorders	892
Congenital Hemolytic Anemias: Red Cell Membrane Defects	893
Congenital Hemolytic Anemias: Hemoglobinopathies	895
Congenital Hemolytic Anemias: Disorders of Red Cell Metabolism	901
Acquired Hemolytic Anemia	903
Polycythemia & Methemoglobinemia	905
Methemoglobinemia	906
Disorders of Leukocytes	906
Neutropenia	906
Neutrophilia	908
Disorders of Neutrophil Function	909
Lymphocytosis	911

Eosinophilia	911
Bleeding Disorders	912
Abnormalities of Platelet Number or Function	913
Inherited Bleeding Disorders	917
Von Willebrand Disease	921
Acquired Bleeding Disorders	922
Vascular Abnormalities Associated with Bleeding	924
Thrombotic Disorders	925
Splenic Abnormalities	928
Splenomegaly & Hypersplenism	928
Asplenia & Splenectomy	928
Transfusion Medicine	930
Donor Screening & Blood Processing: Risk Management	930
Storage & Preservation of Blood & Blood Components	931
Pretransfusion Testing	931
Transfusion Practice	935
References	938

31. Neoplastic Disease 939

<i>Amy K. Keating, MD</i>	
<i>Jessica Knight-Perry, MD, MB</i>	
<i>Kelly Maloney, MD</i>	
<i>Jean M. Mulcahy Levy, MD</i>	
<i>Brian S. Greffe, MD</i>	
<i>Anna R. K. Franklin, MD</i>	
<i>Timothy Price Garrington, MD</i>	
Major Pediatric Neoplastic Diseases	939
Acute Lymphoblastic Leukemia	939
Acute Myeloid Leukemia	942
Myeloproliferative Diseases	945
Brain Tumors	946
Lymphomas & Lymphoproliferative Disorders	950
Neuroblastoma	955
Wilms Tumor (Nephroblastoma)	958
Bone Tumors	959
Rhabdomyosarcoma	961
Retinoblastoma	963
Hepatic Tumors	964
Langerhans Cell Histiocytosis	966
Blood & Marrow Transplant & Cellular Therapeutics	967
General Considerations	967
BMT Complications	968
Cellular Therapeutics	968
Late Effects of Pediatric Cancer Therapy	969
Growth Complications	970

Endocrine Complications	970
Cardiopulmonary Complications	971
Renal Complications	971
Neuropsychological Complications	971
Second Malignancies	971

32. Pain Management & Pediatric Palliative & End-of-Life Care 973

<i>Brian S. Greffe, MD</i>	
<i>Jeffrey L. Galinkin, MD</i>	
<i>Nancy A. King, MSN, RN, CPNP</i>	
Introduction	973
Pain Assessment	973
Acute Pain	973
Chronic Pain Management	975
Pediatric Palliative & End-of-Life Care	978
Introduction	978
Children Who May Benefit From Palliative Care Interventions	978
Pain Management in Pediatric Palliative Care	979
Quality-of-Life Adjuncts & Symptom Management in Pediatric Palliative Care	979
Psychosocial Aspects of Pediatric Palliative Care	979
Children's Concept of Death	980
Spiritual & Cultural Support	981
Withdrawal of Medical Life Support	982
Advance Care Planning	982
References	983

33. Immunodeficiency 984

<i>Jordan K. Abbott, MD, MA</i>	
<i>Pia J. Hauk, MD</i>	
Introduction	984
Immunodeficiency Evaluation: Primary Considerations	984
Severe Combined Immunodeficiency Diseases	988
SCID Classification	990
Other Combined Immunodeficiencies	990
Antibody Deficiency Syndromes	993
Phagocyte Disorders	996
Deficiencies of the Innate Immune System	998
Immunodeficiency Diseases That Present with Autoimmunity	999
Immunodeficiency Diseases That Overlap with Allergy	1000

34. Endocrine Disorders 1003

<i>Sarah Bartz, MD</i>	
<i>Christina Chambers, MD</i>	
<i>Christine M. Chan, MD</i>	
<i>Melanie Cree-Green, MD, PhD</i>	
<i>Shanlee Davis, MD, MSCS</i>	
<i>Stephanie Hsu, MD, PhD</i>	
General Concepts	1003
Hormone Types	1003
Feedback Control of	
Hormone Secretion	1003
Disturbances of Growth	1004
Target Height & Skeletal Maturation	1005
Short Stature	1005
Tall Stature	1011
Disorders of the Posterior Pituitary Gland	1012
Arginine Vasopressin	
(Antidiuretic Hormone) Physiology	1012
Central Diabetes Insipidus	1012
Thyroid Gland	1013
Fetal Development of the Thyroid	1013
Physiology	1013
Hypothyroidism (Congenital & Acquired)	1013
Thyroiditis	1015
Hyperthyroidism	1016
Thyroid Cancer	1018
Disorders of Calcium & Phosphorus	
Metabolism	1018
Hypocalcemic Disorders	1018
Pseudohypoparathyroidism	
(Resistance to Parathyroid	
Hormone Action)	1022
Hypercalcemic States	1022
Familial Hypocalciuric Hypercalcemia	
(Familial Benign Hypercalcemia)	1024
Hypervitaminosis D	1024
Williams Syndrome	1024
Immobilization Hypercalcemia	1024
Hypophosphatasia	1024
Gonads (Ovaries & Testes)	1025
Development	1025
Disorders of Sexual Development	1025
Abnormalities in Female Pubertal	
Development & Ovarian Function	1027
Polycystic Ovarian Syndrome	1030
Abnormalities in Male Pubertal	
Development & Testicular Function	1031
Adrenal Cortex	1033
Adrenocortical Insufficiency	1034

Congenital Adrenal Hyperplasias	1035
Adrenocortical Hyperfunction	1037
Primary Hyperaldosteronism	1038
Uses of Glucocorticoids &	
Adrenocorticotrophic Hormone in	
Treatment of Nonendocrine Diseases	1039
Adrenal Medulla Pheochromocytoma	1040

35. Diabetes Mellitus 1042

<i>Brigitte I. Frohnert, MD, PhD</i>	
<i>Peter H. Chase, MD</i>	
<i>Marian Rewers, MD, PhD</i>	
Quality Assessment	
& Outcomes Metrics	1049
Associated Autoimmune Diseases	
in Type 1 Diabetes	1053
Associated Conditions with	
Type 2 Diabetes	1054
References	1054

36. Inborn Errors of Metabolism 1055

<i>Janet A. Thomas, MD</i>	
<i>Johan L. K. Van Hove, MD, PhD, MBA</i>	
<i>Austin A. Larson, MD</i>	
<i>Peter R. Baker II, MD</i>	
Introduction	1055
Diagnosis	1055
Suspecting Inborn Errors	1055
Laboratory Studies	1056
Common Clinical Situations	1056
Management of Metabolic Emergencies	1057
Newborn Screening	1057
Disorders of Carbohydrate Metabolism	1058
Glycogen Storage Diseases	1058
Galactosemia	1059
Hereditary Fructose Intolerance	1060
Disorders of Energy Metabolism	1060
Disorders of Amino Acid Metabolism	1063
Disorders of the Urea Cycle	1063
Phenylketonuria & the	
Hyperphenylalaninemias	1064
Hereditary Tyrosinemia	1066
Maple Syrup Urine Disease	
(Branched-Chain Ketoaciduria)	1066
Homocystinuria	1067
Nonketotic Hyperglycinemia	1067

Organic Acidemias	1068	Nonmendelian Disorders	1102
Propionic & Methylmalonic Acidemia		Disorders of Imprinting	1102
(Ketotic Hyperglycinemias)	1068	Disorders Associated with Anticipation	1103
Carboxylase Deficiency	1070	Disorders of Multifactorial Inheritance	1104
Glutaric Acidemia Type I	1070	Cleft Lip & Cleft Palate	1104
Disorders of Fatty Acid Oxidation		Neural Tube Defects	1105
& Carnitine	1071	Common Recognizable Disorders with	
Fatty Acid Oxidation Disorders	1071	Variable or Unknown Cause	1106
Carnitine	1072	Genetic Evaluation of the Child with	
Purine Metabolism Disorders	1072	Developmental Disabilities	1108
Lysosomal Diseases	1073	Perinatal Genetics	1109
Peroxisomal Diseases	1076	Teratogens	1109
Congenital Disorders of Glycosylation	1077	Assisted Reproduction	1110
Smith-Lemli-Opitz Syndrome &		Prenatal Diagnosis	1110
Disorders of Cholesterol Synthesis	1077		
Disorders of Brain Specific Metabolism:		38. Allergic Disorders	1112
Neurotransmitters, Synthesis of Amino		<i>Ronina A. Covar, MD</i>	
Acids & Glucose Transport	1078	<i>David M. Fleischer, MD</i>	
Creatine Synthesis Disorders	1079	<i>Christine Cho, MD</i>	
Quality Initiatives in the Field		<i>Mark Boguniewicz, MD</i>	
of Metabolic Disease	1080	Introduction	1112
		Asthma	1112
		Allergic Rhinoconjunctivitis	1132
		Atopic Dermatitis	1136
		Urticaria & Angioedema	1141
		Anaphylaxis	1143
		Adverse Reactions to Drugs & Biologicals	1145
		Food Allergy	1148
		Insect Allergy	1150
		39. Antimicrobial Therapy	1152
37. Genetics & Dysmorphology	1081	<i>Sarah K. Parker, MD</i>	
<i>Naomi J. L. Meeks, MD</i>		<i>Jason Child, PharmD</i>	
<i>Margarita Saenz, MD</i>		<i>Christine E. MacBrayne, PharmD, MSc</i>	
<i>Anne Chun-Hui Tsai, MD, MSc</i>		<i>Andrew Haynes, MD</i>	
<i>Ellen R. Elias, MD</i>		<i>Justin Searns, MD</i>	
Foundations of Genetic Diagnosis	1081	Principles of Antimicrobial Therapy	1152
Cytogenetics	1081	Concepts for Judicious	
Molecular Genetics	1085	Use of Antimicrobials	1152
Principles of Inherited Human Disorders	1087	Susceptibility Testing & Drug	
Mendelian Inheritance	1087	Dosing Properties	1154
Multifactorial Inheritance	1090	Pharmacodynamic Concepts	1154
Nonmendelian Inheritance	1091	Use of Antimicrobial Agents	
Family History & Pedigree	1092	to Prevent Disease	1155
Dysmorphology & Human Embryology	1092	Choice of Antimicrobial Agents	1155
Mechanisms	1093	Specific Antimicrobial Agents	1155
Clinical Dysmorphology	1093	β-Lactam Antibiotics	1155
Chromosomal Disorders: Abnormal		β-Lactam: Penicillins	1156
Number	1094	β-Lactam: Cephalosporins	1170
Trisomies	1094	β-Lactam: Monobactams	1172
Sex Chromosome Abnormalities	1095		
Chromosomal Abnormalities:			
Abnormal Structure	1096		
Chromosome Deletion Disorders	1097		
Contiguous Gene Disorders	1097		
Mendelian Disorders	1098		
Autosomal Dominant Disorders	1098		
Autosomal Recessive Disorders	1100		
X-Linked Disorders	1102		

β -Lactam: Carbapenems	1172
Glycopeptide Agents	1172
Daptomycin	1173
Trimethoprim/Sulfamethoxazole	1173
Metronidazole	1173
Macrolides	1173
Lincosamides	1174
Oxazolidinones	1174
Tetracyclines	1174
Aminoglycosides	1175
Rifamycins	1175
Fluoroquinolones	1176
Antifungals	1176
Antivirals	1177
References	1177

40. Infections: Viral & Rickettsial 1178

<i>Daniel Olson, MD</i>	
<i>Myron J. Levin, MD</i>	
<i>Edwin J. Asturias, MD</i>	
Viral Infections	1178
Respiratory Infections	1178
Viruses Causing the Common Cold	1178
Infections Due to Adenoviruses	1181
Influenza	1184
Parainfluenza (Croup)	1186
Respiratory Syncytial Virus Disease	1187
Human Metapneumovirus Infection	1188
Infections Due to Human Coronaviruses	1189
Infections Due to Enteroviruses & Parechoviruses	1190
Acute Febrile Illness	1190
Respiratory Tract Illnesses	1190
Rashes (Including Hand-Foot-&-Mouth Disease)	1191
Central Nervous System Illnesses	1192
Infections Due to Herpesviruses	1194
Herpes Simplex Infections	1194
Varicella & Herpes Zoster	1197
Roseola Infantum (Exanthem Subitum)	1200
Cytomegalovirus Infections	1201
Infectious Mononucleosis (Epstein-Barr Virus)	1204
Viral Infections Spread by Insect Vectors	1205
Encephalitis	1209
Dengue	1209
Chikungunya	1210
Zika	1211
Colorado Tick Fever	1212
Other Major Viral Childhood Exanthems	1213
Erythema Infectiosum	1213

Measles (Rubeola)	1214
Rubella	1216
Infections Due to Other Viruses	1217
Hantavirus Cardiopulmonary Syndrome	1217
Mumps	1218
Rabies	1219
Rickettsial Infections and Q Fever	1220
Human Ehrlichiosis & Anaplasmosis	1221
Rocky Mountain Spotted Fever	1222
Endemic Typhus (Murine Typhus)	1222
Q Fever	1223

41. Human Immunodeficiency Virus Infection 1224

Elizabeth J. McFarland, MD

Pathogenesis & Epidemiology	1224
Prevention	1226
Perinatally HIV-Exposed Infant	1227
Adolescents & Youth with HIV Exposure	1228
Progressive HIV Disease	1229
Treatment	1231
Quality Assurance & Outcome Metrics	1234

42. Infections: Bacterial & Spirochetal 1236

James Gaensbauer, MD, MScPH

Yosuke Nomura, MD

John W. Ogle, MD

Bacterial Infections	1236
Group A Streptococcal Infections	1236
Group B Streptococcal Infections	1240
Streptococcal Infections with Organisms Other Than Group A or B	1243
Pneumococcal Infections	1244
Staphylococcal Infections	1247
Meningococcal Infections	1251
Gonococcal Infections	1254
Botulism	1256
Tetanus	1258
Gas Gangrene	1260
Diphtheria	1261
Infections Due to Enterobacteriaceae	1263
<i>Pseudomonas</i> Infections	1265
<i>Salmonella</i> Gastroenteritis	1267
Typhoid Fever & Paratyphoid Fever	1269
Shigellosis (Bacillary Dysentery)	1270
Cholera	1271
<i>Campylobacter</i> Infection	1273
Tularemia	1274
Plague	1275
<i>Haemophilus Influenzae</i> Type B Infections	1277

Pertussis (Whooping Cough)	1279	The Spectrum of Signs & Symptoms of Sexually Transmitted Infections	1348
Listeriosis	1281	Cervicitis	1348
Tuberculosis	1283	Pelvic Inflammatory Disease	1349
Infections with Nontuberculous Mycobacteria	1286	Urethritis	1350
<i>Legionella</i> Infection	1287	Epididymitis	1351
<i>Chlamydophila</i> & <i>Chlamydia</i> Infections (Psittacosis, <i>C. Pneumoniae</i> , & <i>C. Trachomatis</i>)	1288	Proctitis, Proctocolitis, & Enteritis	1351
Cat-Scratch Disease	1290	Vaginal Discharge	1351
Spirochetal Infections	1292	Genital Ulcerations	1353
Syphilis	1292	Genital Warts & Human Papillomavirus	1356
Relapsing Fever	1295	Other Viral Infections	1358
Leptospirosis	1296	Ectoparasitic Infections	1359
Lyme Disease	1298	References	1360
43. Infections: Parasitic & Mycotic 1300		45. Travel Medicine 1361	
<i>James Gaensbauer, MD, MScPH</i>		<i>Suchitra Rao, MBBS, MSCS</i>	
<i>Myron J. Levin, MD</i>		Introduction	1361
Parasitic Infections	1300	Preparing Children & Infants for Travel	1361
Protozoal Infections	1301	Vaccinations—Routine Childhood Vaccines Modified for Travel	1363
Systemic Infections	1301	Vaccinations—Travel-Specific	1365
Gastrointestinal Infections	1308	Traveler's Diarrhea	1367
Trichomoniasis	1313	Malaria Prophylaxis & Prevention	1368
Metazoal Infections	1313	Visits to Friends & Relatives (VFR) in High-Risk Areas	1369
Nematode Infections	1313	HIV & Sexually Transmitted Diseases	1369
Cestode Infections (Flukes)	1320	Fever in the Returned Traveler	1372
Trematode Infections	1323	References	1375
Mycotic Infections	1324	46. Chemistry & Hematology Reference Intervals 1376	
<i>Pneumocystis</i> & Other Opportunistic Fungal Infections	1335	<i>Melkon G. DomBourian, MD</i>	
<i>Pneumocystis Jiroveci</i> Infection	1337	<i>Aimee LeDoux, MT (ASCP)</i>	
44. Sexually Transmitted Infections 1339		<i>Jordana E. Hoppe, MD</i>	
<i>Daniel H. Reirden, MD</i>		<i>Robert Snyder, MT (ASCP)</i>	
<i>Ann-Christine Nyquist, MD, MSPH</i>		Challenges in Determining & Interpreting Pediatric Reference Intervals	1376
Introduction	1339	Guidelines for Use of Data in a Reference Range Study	1376
Adolescent Sexuality	1339	Statistical Computation of Reference Intervals	1377
Risk Factors	1340	Why Reference Intervals Vary	1378
Prevention of Sexually Transmitted Infections	1340	Sensitivity, Specificity, & Predictive Values	1378
Screening for Sexually Transmitted Infections	1340	Pediatric Reference Intervals	1379
Signs & Symptoms	1341	Index 1393	
The Most Common Antibiotic-Responsive Sexually Transmitted Infections	1341		
<i>Chlamydia Trachomatis</i> Infection	1341		
<i>Neisseria Gonorrhoeae</i> Infection	1342		