

FIFTH EDITION



Maternal, Fetal, & Neonatal Physiology

A Clinical Perspective



B0052258

ห้องสมุดวพ.นครราชสีมา

LUCKER BLACKBURN

ELSEVIER

Contents

UNIT I

Reproductive and Developmental Processes

1 *Biologic Basis for Reproduction, 1*

- Chromosomes and Genes, 1
 - Chromosomes, 1
 - Genes, 2
 - DNA and RNA, 4
 - Genomics and Epigenetics, 5
 - Cell Division, 6
 - Mitosis, 6
 - Meiosis, 7
 - Gametogenesis, 8
 - Oogenesis, 8
 - Spermatogenesis, 10
 - Abnormal Gamete Development, 10
 - Genetic and Chromosomal Disorders, 11
 - Alterations in Chromosome Number, 11
 - Alterations in Chromosome Structure, 13
 - Gene Disorders, 14
 - Modes of Inheritance, 15
 - Autosomal Inheritance, 16
 - Sex-Linked Inheritance, 17
 - Multifactorial Inheritance, 17
 - Nontraditional Modes of Inheritance, 18
 - Embryonic and Fetal Development of the Reproductive System, 19
 - Development of the Primordial Germ Cells, 20
 - Development of the Gonads, 20
 - Development of the Genital Ducts, 21
 - Development of the External Genitalia, 22
 - Anomalies of the Genital Tract, 24
 - Clinical Implications, 25
 - Genetic Screening, 25
 - Genetic Disorders and Pregnancy, 26
 - Summary, 26
- #### 2 *Physiologic Basis for Reproduction, 29*
- Hypothalamic-Pituitary-Ovarian/Testicular Axis, 29
 - Hormones, 29
 - Hormone Activators, Receptors, and Messenger Systems, 29
 - Hormone Storage, 30
 - Hypothalamic and Pituitary Glands, 31
 - Reproductive Hormones in Females and Males, 33
 - Luteinizing Hormone, 35
 - Follicle-Stimulating Hormone, 35
 - Activin, 35
 - Inhibin, 37

- Follistatin, 37
- Steroid Hormones, 37
- Oocyte Maturation Inhibitor, 43
- Luteinization Inhibitor, 43
- Gonadotropin Surge–Inhibiting Factor, 43
- Relaxin, 43
- Feedback Systems, 43
- Reproductive Processes in the Female and Male, 44
 - Oogenesis, 44
 - Spermatogenesis, 45
 - Puberty, 45
 - Ovarian Cycle, 48
 - Menstruation, 53
 - Endometrial Cycle, 53
 - Gestational Follicular Development, 56
 - Male Reproductive Endocrinology, 56
 - Climacteric, 57
 - Aging Male, 58
- Summary, 59

3 *Prenatal Period and Placental Physiology, 61*

- Overview of Pregnancy, 61
 - First Trimester, 61
 - Second Trimester, 62
 - Third Trimester, 63
- Conception, 63
 - Ovulation, 63
 - Corpus Luteum, 65
 - Sperm Transport, 65
 - Fertilization, 66
 - Cleavage and Zygote Transport, 68
- Embryonic and Fetal Development, 69
- Regulation of Development, 69
 - Mechanisms of Morphogenesis, 71
 - Overview of Embryonic Development, 73
 - Overview of Fetal Development, 78
 - Intrauterine Environment, 79
- The Placenta and Placental Physiology, 79
 - Placental Development, 79
 - Placental Structure, 85
 - Placental Circulation, 85
 - Placental Function, 89
- Umbilical Cord, 95
- Amnion and Chorion, 96
- Amniotic Fluid, 96
 - Amniotic Fluid Volume and Turnover, 96
 - Amniotic Fluid Production and Disposition, 97
 - Composition of Amniotic Fluid, 97

- Clinical Implications, 97
 - Assisted Reproductive Technology, 97
 - Assessment of the Embryo and Fetus, 99
 - Alterations in Placenta, Umbilical Cord, and Amniotic Fluid, 102
 - Multiple Gestation, 106
- Summary, 110

4 Parturition and Uterine Physiology, 115

- Uterus, 115
 - Uterine Structure, 115
 - Uterine Growth, 116
- Myometrium, 116
 - Myometrial Cell Structure, 116
 - Changes During Pregnancy, 118
- Cervix, 118
 - Structure of the Cervix, 119
 - Changes During Pregnancy, 119
 - Cervical Ripening and Dilation, 119
- Rupture of Fetal Membranes, 121
- Parturition, 121
 - Initiation of Labor, 122
 - Endocrine and Other Factors, 124
 - Myometrial Contraction, 128
 - Coordination of Uterine Contractions, 129
- Clinical Implications for the Pregnant Woman and Her Fetus, 131
 - Maternal Position During Labor, 131
 - Maternal Pushing Efforts During the Second Stage, 132
 - Preterm Labor and Birth, 133
 - Altering Uterine Motility and Cervical Ripening, 135
 - Dystocia, 137
 - Postterm Labor, 137
- Summary, 137

5 Postpartum Period and Lactation Physiology, 142

- Involution of the Reproductive Organs, 142
 - Uterus, 142
 - Cervix, Vagina, and Perineum, 143
 - Physical Activity and Sexual Function, 144
- Endocrine Changes, 144
 - Estrogen and Progesterone, 144
 - Pituitary Gonadotropin, 145
 - Prolactin, 145
 - Oxytocin, 145
- Resumption of Menstruation and Ovulation, 145
- Anatomy of the Mammary Glands, 146
- Physiology of Lactation, 147
 - Embryogenesis, 147
 - Mammogenesis, 148
 - Lactogenesis, 148
 - Prolactin Patterns During Lactation, 149
 - Oxytocin Release During Lactation, 150
 - Mammary Involution, 151

- Human Milk, 151
 - Importance of Human Milk, 151
 - Milk Production and Composition, 151
 - Human Milk for the Preterm Infant, 155
- Nutrition During the Postpartum Period and Lactation, 157
 - Common Breastfeeding Problems, 157
 - Social and Cultural Barriers to Breastfeeding, 158
 - Summary, 159

6 Fetal Assessment, 162

- Physiology of Fetal Heart Function, 162
 - Autonomic Control of Fetal Heart Rate, 162
- Fetal Acid-Base Physiology, 163
- Uteroplacental Circulation and Gas Exchange, 163
 - Uterine Blood Flow in the Intervillous Space, 164
 - Umbilical Blood Flow, 165
 - Placental Area, 165
 - Transfer of Oxygen and Carbon Dioxide, 165
- Fetal Response to Hypoxia, 166
 - Acute Fetal Hypoxia, 166
 - Chronic Fetal Hypoxemia, 166
 - Severe Asphyxia: Hypoxic-Ischemic Encephalopathy and Neonatal Encephalopathy, 167
 - Newborn Umbilical Cord Gas Analysis, 168
- Characteristics of the Fetal Heart Rate, 169
 - Beat-to-Beat Variability, 169
 - Accelerations, 170
 - Alterations in Fetal Heart Rate, 170
 - Periodic and Episodic Fetal Heart Rate Decelerations, 171
 - Sinusoidal Pattern, 172
 - Fetal Heart Rate Pattern Evolution, 172
- Third Trimester Fetal Assessment Techniques, 173
 - Fetal Movement, 174
 - Nonstress Test, 174
 - Vibroacoustic Stimulation, 175
 - Contraction Stress Test, 175
 - Amniotic Fluid Index, 175
 - Biophysical Profile, 175
 - Umbilical Artery Doppler Velocimetry, 176
- Clinical Implications: Intrapartum Fetal Assessment and Therapeutic Interventions, 176
 - Electronic Fetal Monitoring, 176
 - Therapeutic Interventions, 177
- Summary, 177

7 Pharmacology and Pharmacokinetics During the Perinatal Period, 180

- Pharmacokinetics, 180
- Pharmacogenetics and Pharmacogenomics, 181
- Pharmacokinetics During Pregnancy, 182
 - Drug Use During Pregnancy, 182
 - Alterations in Drug Absorption, Distribution, Metabolism, and Excretion During Pregnancy, 183
 - Alterations in Drug Absorption, Distribution, Metabolism, and Excretion During the Intrapartum and Postpartum Periods, 187

- Transfer of Drugs Across the Placenta, 187
- Summary, 193
- Pharmacokinetics in the Fetus, 194
 - Drug Distribution, Metabolism, and Excretion in the Fetus, 194
 - Fetal Drug Therapy, 195
- Neonatal Pharmacokinetics, 196
 - Drug Absorption, 197
 - Drug Distribution, 198
 - Hepatic Drug Metabolism, 199
 - Renal Drug Excretion, 201
- Summary, 201
- Clinical Implications for the Pregnant Woman, Fetus, and Neonate, 202
 - Teratogenesis, 202
 - Effects of Drug Exposure in Utero, 205
 - Drugs and Lactation, 208
- Summary, 211

UNIT II

Adaptations in Major Body Systems in the Pregnant Woman, Fetus, and Neonate

8 Hematologic and Hemostatic Systems, 215

- Maternal Physiologic Adaptations, 215
 - Antepartum Period, 215
 - Intrapartum Period, 222
 - Postpartum Period, 223
- Clinical Implications for the Pregnant Woman and Her Fetus, 224
 - Iron Requirements During Pregnancy, 224
 - Anemia and Pregnancy, 225
 - Thromboembolism and Pregnancy, 227
 - Platelet and Coagulation Disorders During Pregnancy, 227
- Summary, 228
- Development of the Hematologic System in the Fetus, 229
 - Formation of Blood Cells, 229
 - Formation of Hemoglobin, 231
 - Fetal Iron Requirements, 232
 - Development of the Hemostatic System, 233
- Neonatal Physiology, 233
 - Transitional Events, 233
 - Changes in Hematologic Parameters, 234
 - Alterations in Hemostasis, 236
- Clinical Implications for Neonatal Care, 238
 - Factors Influencing Hematologic Parameters, 238
 - Alterations in Hemoglobin–Oxygen Affinity, 239
 - Vitamin K Deficiency Bleeding, 239
 - Physiologic Anemia of Infancy, 240
 - Anemia of Prematurity, 242
 - Iron Supplementation, 243
 - Blood Transfusions, 243
 - Neonatal Polycythemia and Hyperviscosity, 243
 - Infants With a Hemoglobinopathy, 244

- Infants at Risk for Altered Platelets and Hemostasis, 244
- Maturational Changes During Infancy and Childhood, 245
 - Changes in Hematologic Parameters, 245
 - Changes in Oxygen–Hemoglobin Affinity, 246
- Summary, 246

9 Cardiovascular System, 251

- Maternal Physiologic Adaptations, 251
 - Antepartum Period, 251
 - Intrapartum Period, 258
 - Postpartum Period, 258
- Clinical Implications for the Pregnant Woman and Her Fetus, 259
 - Arrhythmias, 259
 - Supine Hypotension, 259
 - Exercise During Pregnancy: Cardiovascular Effects, 260
 - Multiple Pregnancy, 262
 - Cardiac Disease and Pregnancy, 262
 - Peripartum Cardiomyopathy, 265
 - Hypertensive Disorders, 265
- Summary, 268
- Development of the Cardiovascular System in the Fetus, 268
 - Anatomic Development, 269
 - Developmental Basis for Common Anomalies, 275
 - Functional Development, 276
- Neonatal Physiology, 280
 - Transitional Events, 280
 - Neonatal Myocardium, 283
 - Pulmonary Vasculature, 283
 - Metabolic Rate and Oxygen Transport, 283
 - Myocardial Performance in the Neonate, 284
 - Regulation of Fetal and Neonatal Circulation, 286
- Clinical Implications for Neonatal Care, 287
 - Assessment of Heart Sounds, 287
 - Cardiac Shunts, 287
 - Cyanosis, 287
 - Patent Ductus Arteriosus in the Preterm Infant, 288
 - Congenital Heart Defects, 288
- Maturational Changes During Infancy and Childhood, 291
- Summary, 292

10 Respiratory System, 297

- Maternal Physiologic Adaptations, 297
 - Antepartum Period, 297
 - Intrapartum Period, 301
 - Postpartum Period, 303
- Clinical Implications for the Pregnant Woman and Her Fetus, 303
 - Pregnancy-Related Dyspnea, 303
 - Upper Respiratory Tract Capillary Engorgement, 303
 - Exercise, 304
 - Effects of Altitude and Air Travel, 304
 - Pulmonary Disease and Pregnancy, 305
 - Smoking, 306

- Inhalation Anesthesia, 307
- Summary, 307
- Development of the Respiratory System in the Fetus, 308
 - Anatomic Development, 308
 - Functional Development, 312
- Neonatal Physiology, 318
 - Transitional Events, 319
 - Control of Respiration, 322
 - Upper Airway, 325
 - Respiratory Pump, 325
 - Mechanical Properties of the Respiratory System, 328
 - Ventilation, 329
 - Lung Volumes, 329
 - Pulmonary Blood Flow, 330
 - Ventilation-Perfusion Relationships, 330
 - Oxygen-Hemoglobin Dissociation Curve, 333
- Clinical Implications for Neonatal Care, 334
 - Physiologic Basis for Clinical Findings, 335
 - Periodic Breathing and Apnea of Prematurity, 336
 - Respiratory Outcomes in Preterm Infants, 337
 - Hypoxia and Hyperoxia, 337
 - Transient Tachypnea of the Newborn, 339
 - Respiratory Distress Syndrome, 339
 - Bronchopulmonary Dysplasia, 342
 - Meconium Aspiration Syndrome, 343
 - Persistent Pulmonary Hypertension of the Newborn, 344
- Maturational Changes During Infancy and Childhood, 345
- Summary, 346
- 11 Renal System and Fluid and Electrolyte Homeostasis, 351**
- Maternal Physiologic Adaptations, 351
 - Antepartum Period, 351
 - Intrapartum Period, 359
 - Postpartum Period, 359
- Clinical Implications for the Pregnant Woman and Her Fetus, 360
 - Urinary Frequency, Incontinence, and Nocturia, 360
 - Dependent Edema, 361
 - Effects of Position on Renal Function, 361
 - Inability to Void Postpartum, 361
 - Risk of Urinary Tract Infection, 361
 - Fluid Needs in Labor, 362
 - Maternal-Fetal Fluid and Electrolyte Homeostasis, 362
 - Evaluation of Renal Function During Pregnancy, 363
 - Hypertension and the Renal System, 364
 - Renal Disease and Pregnancy, 364
- Summary, 364
- Development of the Renal System in the Fetus, 365
 - Anatomic Development, 366
 - Developmental Basis for Common Anomalies, 367
 - Functional Development, 368
- Neonatal Physiology, 369
 - Transitional Events, 370
 - Body Composition, 370
 - Bladder, 371
 - Urine Output and Micturition, 371
 - Renal Blood Flow and Glomerular Filtration, 371
 - Tubular Function, 373
 - Water Balance, 375
 - Hormonal Regulation, 376
- Clinical Implications for Neonatal Care, 377
 - Fluid and Electrolyte Balance, 377
 - Risk of Overhydration and Dehydration, 380
 - Electrolyte Imbalances, 380
 - Measurement of Renal Function and Hydration Status, 381
 - Renal Function During Neonatal Illness, 381
- Maturational Changes During Infancy and Childhood, 382
- Summary, 383
- 12 Gastrointestinal and Hepatic Systems and Perinatal Nutrition, 387**
- Maternal Physiologic Adaptations, 387
 - Antepartum Period, 387
 - Intrapartum Period, 393
 - Postpartum Period, 393
- Clinical Implications for the Pregnant Woman and Her Fetus, 394
 - Nutritional Requirements of Pregnancy, 394
 - Heartburn and Gastroesophageal Reflux, 395
 - Constipation, 397
 - Hemorrhoids, 397
 - Nausea and Vomiting, 397
 - Food and Fluid Intake in Labor, 398
 - Effects of Altered Maternal Nutrition, 398
 - Pregnancy and Gastrointestinal Disorders, 399
 - Pregnancy and Liver Disease, 401
- Summary, 401
- Development of the Gastrointestinal and Hepatic Systems in the Fetus, 402
 - Anatomic Development, 402
 - Functional Development, 408
 - Fetal Growth, 409
- Neonatal Physiology, 410
 - Transitional Events, 411
 - Functional and Anatomic Maturation, 413
 - Physiologic Limitations, 415
- Clinical Implications for Neonatal Care, 419
 - Infant Growth, 419
 - Nutritional Requirements of Term and Preterm Infants, 420
 - Composition of Feedings, 421
 - Human Milk, 423
 - Parenteral Nutrition Solutions, 424
 - Issues in Infants With Various Health Problems, 424
 - Considerations Related to Feeding Method, 425
 - Regurgitation and Reflux, 426
 - Necrotizing Enterocolitis, 427
- Maturational Changes During Infancy and Childhood, 428
 - Introduction of Solid Foods, 428
- Summary, 428

13 Immune System and Host Defense Mechanisms, 435

- Maternal Physiologic Adaptations, 435
 - Antepartum Period, 435
 - Intrapartum Period, 444
 - Postpartum Period, 444
- Clinical Implications for the Pregnant Woman and Her Fetus, 445
 - Spontaneous Abortion, 445
 - Risk of Maternal Infection, 446
 - Inflammation, Infection, and Preterm Labor, 446
 - Infections and Neurodevelopmental Disorders in Offspring, 447
 - Immunization and the Pregnant Woman, 447
 - The Pregnant Woman With an Autoimmune Disease, 448
 - Fetal and Neonatal Complications Associated With Transplacental Passage of Maternal Antibodies, 448
 - Rho(D) Alloimmunization and ABO Incompatibility, 449
- Summary, 451
- Development of Host Defense Mechanisms in the Fetus, 452
- Neonatal Physiology, 453
 - Transitional Events, 453
 - Alterations in Innate Immunity, 455
 - Alterations in the Complement System, 458
 - Alterations in Adaptive Immunity, 458
 - Gut Host Defense Mechanisms, 460
- Clinical Implications for Neonatal Care, 461
 - Neonatal Vulnerability to Infection, 461
 - Limitations in Immune Responses to Bacterial Infections, 461
 - Immune Responses to Viral Infections, 462
 - Diagnosis of Neonatal Infection, 463
- Maturational Changes During Infancy and Childhood, 464
 - Maturation of Host Defense Factors, 464
 - Physiologic Hypogammaglobulinemia, 465
 - Immunizations, 465
 - Development of Allergic Disease, 466
- Summary, 466

14 Integumentary System, 471

- Maternal Physiologic Adaptations, 471
 - Antepartum Period, 471
 - Postpartum Period, 475
- Clinical Implications for the Pregnant Woman and Her Fetus, 478
 - Dermatoses Associated With Pregnancy, 478
 - Effects of Pregnancy on Preexisting Skin Disorders, 478
- Summary, 478
- Development of the Integumentary System in the Fetus, 479
 - Anatomic Development, 479
 - Functional Development, 484
- Neonatal Physiology, 484

- Transitional Events, 484
- Barrier Properties, 487
- Thermal Environment, 488
- Cohesion Between Epidermis and Dermis, 489
- Collagen and Elastin Instability, 489
- Cutaneous Blood Flow, 489
- Clinical Implications for Neonatal Care, 489
 - Bathing, 490
 - Umbilical Cord Care, 491
 - Use of Adhesives, 491
 - Protection From Infection, 491
 - Transepidermal Absorption, 491
 - Extremely Immature Infants, 492
- Maturational Changes During Infancy and Childhood, 493
- Summary, 493

15 Neurologic, Muscular, and Sensory Systems, 497

- Maternal Physiologic Adaptations, 497
 - Antepartum Period, 497
 - Intrapartum Period, 500
 - Postpartum Period, 502
- Clinical Implications for the Pregnant Woman and Her Fetus, 503
 - Ocular Adaptations, 503
 - Musculoskeletal Discomforts, 504
 - Headache, 505
 - The Pregnant Woman With a Chronic Neurologic Disorder, 506
 - Peripheral Neuropathies, 507
 - The Woman With a Spinal Cord Injury, 507
 - Cerebral Vascular Disorders, 508
 - Preeclampsia and Eclampsia, 508
- Summary, 509
- Development of the Neurologic, Muscular, and Sensory Systems in the Fetus, 510
 - Anatomic Development of the Central Nervous System, 510
 - Fetal Neurodevelopment, 515
 - Functional Development, 518
- Neonatal Physiology, 522
 - Transitional Events, 522
 - Circulation in the Neonatal Brain, 523
 - Neonatal Sensory Function, 524
 - Neural (Brain) Plasticity, 526
 - Neonatal Motor Function, 526
 - Sleep-Wake Pattern, 528
 - Neurobehavioral Organization, 529
- Clinical Implications for Neonatal Care, 530
 - Risks Posed by the Caregiving Environment, 530
 - Vulnerability to Brain Injury in Preterm and Term Infants, 530
 - Neonatal Seizures, 534
 - Neonatal Pain, 535
- Maturational Changes During Infancy and Childhood, 537
- Summary, 537

UNIT III**Adaptations in Metabolic Processes in the Pregnant Woman, Fetus, and Neonate****16 Carbohydrate, Fat, and Protein Metabolism, 543**

- Maternal Physiologic Adaptations, 543
 - Antepartum Period, 543
 - Intrapartum Period, 551
 - Postpartum Period, 551
- Clinical Implications for the Pregnant Woman and Her Fetus, 551
 - Effects of Metabolic Changes on Glucose Tolerance Tests, 551
 - Maternal-Fetal Relationships, 552
 - The Pregnant Diabetic Woman, 553
- Summary, 555
- Development of Carbohydrate, Fat, and Protein Metabolism in the Fetus, 555
 - Carbohydrate Metabolism, 556
 - Lipid Metabolism, 559
 - Protein Metabolism, 560
- Neonatal Physiology, 560
 - Transitional Events, 560
 - Carbohydrate Metabolism, 561
 - Lipid Metabolism, 562
 - Protein Metabolism, 563
- Clinical Implications for Neonatal Care, 563
 - Neonatal Hypoglycemia, 563
 - Neonatal Hyperglycemia, 566
- Maturational Changes During Infancy and Childhood, 567
- Summary, 567

17 Calcium and Phosphorus Metabolism, 571

- Maternal Physiologic Adaptations, 571
 - Antepartum Period, 571
 - Intrapartum Period, 575
 - Postpartum Period, 575
- Clinical Implications for the Pregnant Woman and Her Fetus, 575
 - Maternal Nutritional Needs, 575
 - Leg Cramps, 576
 - Maternal Calcium Metabolism and Pregnancy Complications, 576
 - Maternal-Fetal Interactions, 577
- Summary, 578
- Development of Calcium and Phosphorus Metabolism in the Fetus, 578
 - Anatomic Development, 578
 - Functional Development, 579
- Neonatal Physiology, 580
 - Transitional Events, 580
 - Calcium, 580
 - Phosphorus, 581
 - Parathyroid Hormone, 581

- Vitamin D, 581
- Calcitonin, 581
- Magnesium, 581
- Clinical Implications for Neonatal Care, 582
 - Calcium Intake in Preterm Infants, 582
 - Bone Mineralization, 582
 - Alterations in Neonatal Calcium Homeostasis, 582
 - Alterations in Neonatal Magnesium Homeostasis, 585
 - Neonatal Osteopenia and Rickets, 585
- Maturational Changes During Infancy and Childhood, 586
- Summary, 586

18 Bilirubin Metabolism, 589

- Maternal Physiologic Adaptations, 589
- Clinical Implications for the Pregnant Woman and Her Fetus, 589
 - Maternal Hyperbilirubinemia, 589
- Development of Bilirubin Metabolism in the Fetus, 591
- Neonatal Physiology, 592
 - Transitional Events, 592
 - Benefits of Bilirubin, 592
 - Bilirubin Production in the Neonate, 593
 - Physiologic Jaundice, 593
- Clinical Implications for Neonatal Care, 596
 - Neonatal Hyperbilirubinemia, 596
 - Breastfeeding and Neonatal Jaundice, 597
 - Measurement of Serum Bilirubin, 599
 - Management of Neonatal Hyperbilirubinemia, 599
 - Competition for Albumin Binding, 603
 - Acute Bilirubin Encephalopathy and Kernicterus, 604
- Maturational Changes During Infancy and Childhood, 605
- Summary, 605

19 Pituitary, Adrenal, and Thyroid Function, 609

- Maternal Physiologic Adaptations, 609
 - Antepartum Period, 609
 - Intrapartum Period, 615
 - Postpartum Period, 615
- Clinical Implications for the Pregnant Woman and Her Fetus, 616
 - Iodine Needs During Pregnancy, 616
 - Thyroid Function Tests During Pregnancy, 616
 - Thyroid Function and Nausea and Vomiting in Pregnancy, 617
 - The Pregnant Woman With Hyperthyroidism, 617
 - The Pregnant Woman With Hypothyroidism, 618
 - Postpartum Thyroid Disorders, 619
 - Breastfeeding in Women With Thyroid Disorders, 619
 - Use of Radioiodine and Iodides, 620
 - Maternal-Fetal Endocrine Relationships, 620
- Summary, 622

- Development of Hypothalamic, Pituitary, Adrenal, and Thyroid Function in the Fetus, 623
 - Hypothalamus and Pituitary Gland, 623
 - Adrenal Glands, 624
 - Thyroid Gland, 626
- Neonatal Physiology, 628
 - Transitional Events, 628
 - Hypothalamic-Pituitary-Adrenal Axis, 628
 - Hypothalamic-Pituitary-Thyroid Axis, 628
- Clinical Implications for Neonatal Care, 629
 - Neonatal Stress, 630
 - Thyroid Function and Thermoregulation, 631
 - Transient Alterations in Thyroid Function in Preterm Infants, 631
 - Neonatal Hyperthyroidism, 632
 - Neonatal Hypothyroidism, 633
 - Congenital Adrenal Hyperplasia, 633
- Maturational Changes During Infancy and Childhood, 634
 - Summary, 634
- 20 Thermoregulation, 639***
 - Maternal Physiologic Adaptations, 639
 - Antepartum Period, 639
 - Intrapartum Period, 639
 - Postpartum Period, 640
 - Clinical Implications for the Pregnant Woman and Her Fetus, 641
 - Maternal Hyperthermia and Fever, 641
 - Maternal Exercise and Temperature Elevations, 641
 - Summary, 642
 - Development of Thermoregulation in the Fetus, 642
 - Neonatal Physiology, 643
 - Transitional Events, 643
 - Heat Exchange, 645
 - Brown Adipose Tissue Metabolism, 646
 - Heat Dissipation and Loss, 648
 - Clinical Implications for Neonatal Care, 648
 - Neutral Thermal Environment, 648
 - Prevention of Excessive Heat Loss or Heat Gain, 649
 - Monitoring Temperature, 651
 - Methods of Promoting Thermal Stability, 652
 - Neonatal Hypothermia and Cold Stress, 654
 - Use of Hypothermia for Neuroprotection, 654
 - Hyperthermia and Fever in the Neonate, 656
 - Maturational Changes During Infancy and Childhood, 657
 - Summary, 657
- Appendix A: List of Abbreviations, 661***
- Index, 667***