

Contents

Contributors	<i>xxxiii</i>
Preface	<i>xxxvii</i>
Acknowledgments	<i>xxxix</i>
Disclaimer	<i>xli</i>
About the Companion Website	<i>xlili</i>

Section I Introduction 1

1 Exotic Animals in Clinical Practice	3
<i>Bonnie Ballard</i>	
References	8

Section II Analgesia and Anesthesia 9

2 Exotic Anesthesia and Analgesia	11
<i>Jody Nugent-Deal</i>	
Pre-anesthetic Assessment	11
Physical Examination	11
Venipuncture	14
Preparing for Anesthesia	14
Fluids	17
Anesthetic Induction	18
Reptiles	18
Birds	20
Exotic Companion Mammals	22
Small Rodents	23
Guinea Pigs	23
Chinchillas	24
Ferrets	24
Rabbits	24
Multimodal Anesthetic Techniques	27
Epidurals	27
Constant Rate Infusions	30
Local Anesthetic Techniques	30
Topical Anesthetics	30
Infiltration of Local Anesthetics	31

Ring Blocks	31
Testicular Blocks	31
Recovery and Postoperative Management	31
References	33
3 Anesthetic Equipment and Monitoring for Exotic Patients	35
<i>Katrina Lafferty</i>	
Introduction	35
Breathing Systems	35
Rebreathing Circuits	35
Non-rebreathing Circuits	35
Mapleson A (Magill, Lack, and Modified Mapleson A)	37
Mapleson D (Bain, Modified Mapleson D)	37
Mapleson F (Jackson–Rees Modified Ayre t-piece)	38
Intubation	38
Murphy-style Endotracheal Tubes	38
Cole-style Endotracheal Tubes	39
Reinforced (armored) Endotracheal Tubes	39
Laryngeal Mask Airway Tubes	39
Miscellaneous Endotracheal Tubes	40
Laryngoscopes	40
Monitoring	41
Pulse Oximetry	41
Capnography	42
Non-invasive Blood Pressure Monitoring	44
Electrocardiography	45
Temperature and Thermal Support	46
Recovery	47
Incubators	47
Recovery Room	47
Recovery Room Emergency Kit	48
References	48
4 Physical Rehabilitation	49
<i>Jodi Seidel</i>	
Introduction	49
Why Rehab?	49
Where to Start—Asking the Right Questions	50
The Rehab Examination	50
Putting It All Together	52
Physical Rehab Techniques: The Why and The How	53
How to Perform PROM	53
Avian Species	53
Massage	53
Common Rehab Modalities Used in Exotic Medicine	56
Adaptive Devices Used in Exotic Patient Medicine	58
Conclusion	58
References	59
Additional Resources	59

Section III Avian 61**5 Psittacine and Passerine Birds 63***Cheryl B. Greenacre and Janet L. Pezzi-Jones*

Introduction 63

Anatomy and Physiology 63

Integumentary System 63

Musculoskeletal System 66

Cardiovascular System 66

Renal System 66

Neurology and Ophthalmology 67

Respiratory System 68

Digestive System 69

Reproductive System 70

Lifespan and Longevity 70

Comparative Clinical Pathology 70

Nutrition 71

History, Restraint, and Physical Examination 72

History 73

Restraint 74

Physical Examination 75

Common Diseases 77

Infectious Diseases 77

Avian Chlamydiosis 77

Other Bacterial Infections 78

Canary Pox 78

Polyomavirus 79

Proventricular Dilation Disease 79

Psittacine Beak and Feather Disease 80

Papillomatosis Caused by Psittacine Herpesvirus 3 80

West Nile Virus 80

Avian Influenza 81

Fungal Diseases 81

Aspergillosis 81

Candidiasis 81

Non-infectious Diseases 81

Heavy Metal Toxicosis 81

Hypovitaminosis A 82

Hypocalcemia of African Grey Parrots 82

Non-stick Cookware Toxicosis 82

Egg Binding 82

Crop Burns 83

Radiology 83

Anesthesia and Analgesia 84

Surgery 86

Parasitology 86

Gender Determination 87

Grooming (Beak, Nail, and Wing Trims) 87

- Nails 87
- Beak 87
- Wing 88
- Emergency and Critical Care 89
 - Blood Loss 90
 - Dehydration 90
- Clinical Techniques 90
 - Blood Feather Removal 90
 - Catheter Placement 90
 - Intraosseous Catheters 90
 - Air Sac Tube 91
 - Blood Collection 91
 - Jugular Vein 91
 - Basilic Vein 92
 - Medial Metatarsal Vein 92
- Administration of Medications 92
 - Additives to Water 93
 - Additives to Food 93
 - Direct Oral Medication 93
 - Intramuscular Injection of Medication 93
 - Intravenous Medications 94
 - Intraosseous Medication 94
 - Subcutaneous Medication 94
 - Topical 94
 - Nebulization 94
 - Sinus/Nasal Flushing 94
 - Tube feeding 94
- Diagnostic Sampling 95
- Wound Care and Bandaging 96
- Euthanasia 96
- Acknowledgment 97
- References 97

6 Psittacine Behavior, Husbandry, and Enrichment 99

April Romagnano, Tarah Hadley, Ashley McGaha, and Jan Hooimeijer

- Introduction 99
- Behavior of Common Pet Psittacine Species 101
 - Lories and Lorikeets 101
 - Cockatoos 102
 - Budgerigar 102
 - Eclectus 102
 - Cockatiel 103
 - African Grey 103
 - Senegal 104
 - Lovebirds 104
 - Macaws 104
 - Conures 104
 - Parrotlet 105
 - Amazon 105
- Husbandry 106
 - The Cage Environment 106

Perches	106
The Cage Bottom	107
Toys and Non-toy Enrichment Items	107
Cage Location	108
Normal Behavior of Psittacine Bird Species	108
Bathing	108
Playing on the Cage Bottom	108
Preening and Molting	108
Sleeping	109
Regurgitation	109
Eye Movements	109
Body Shivering	109
Vocalizations	109
Abnormal Behavior	109
Feather Destructive Behaviors	110
Sitting on the Cage Bottom	110
Fluffed Feathers and Shivering	110
Regurgitation and Vomiting	110
Mean Bird Turned Friendly	110
Decreased or No Fecal Production	110
Open Mouth Breathing and Tail Bobbing	111
Falling Off Perch	111
Inappropriate Molting	111
References	111
Further Reading	112
7 Aviary Design and Management	113
<i>April Romagnano</i>	
Introduction	113
Aviculture	113
Quarantine	113
Examinations and Diagnostic Testing	115
Neonates, Juveniles, Breeders, and New Acquisitions	115
Disinfection and Disease Prevention	115
Pediatrics for the Aviculturist	116
Pediatric History Evaluation	116
Frequent Examination of Young Birds	116
Pediatric Diagnostics	117
Clinical Pathology	117
Microbiology	117
Radiology	117
Endoscopy	117
Pediatric Problems	117
Common Pediatric Problems	117
Less Common Pediatric Problems	117
Diseases in the Nursery	117
Viral Diseases	117
Microbial Diseases	117
Chlamydia	117
Conclusion	117
Additional Reading	118

8 Sex Differentiation and Reproduction 119

April Romagnano and Tarah Hadley

Introduction 119

Sex Differentiation 119

Visual Sexing 119

Vent Sexing 119

Surgical Sexing 120

Feather Sexing 120

DNA or Blood Sexing 120

Reproduction 120

Female 120

Male 121

Reproductive Medicine and Surgery 121

Normal Oviposition 121

Post-incubation and Hatching 121

Abnormal Oviposition or Dystocia 121

Additional Reading 123

Section IV Reptiles 125

9 Lizards 127

Stacey Leonatti Wilkinson and Brad Wilson

Introduction 127

Anatomy and Physiology 128

Integument 128

Skeletal System 131

Cardiovascular System 132

Respiratory System 132

Digestive System 133

Excretory System 133

Reproductive System 134

Nervous System 135

Sense Organs 135

Husbandry 135

Enclosures and Environment 136

Cages 136

Lighting 137

Heating 139

Humidity and Ventilation 139

Water and Food Availability 140

Quarantine 140

Nutrition 141

Herbivorous Lizards 142

Insectivorous Lizards 143

Carnivorous Lizards 143

Common Disorders 144

Integument 144

Trauma 145

Skeletal System 146

Cardiovascular System 147

Respiratory System 147

Digestive System	148
Excretory System	149
Reproductive System	150
Nervous System	150
Ophthalmology	151
Behavior	151
Toxicity	152
Nutritional Disorders	152
Zoonoses	152
History, Restraint, and Physical Examination	154
History	154
Restraint	154
Physical Examination	155
Radiology	158
Anesthesia and Surgery	159
Anesthesia	159
Surgery	161
Parasitology	162
External Parasites	162
Internal Parasites	163
Protozoans	163
Coccidia	164
Cestodes	164
Nematodes	165
Clinical Techniques	165
Intravenous and Intraosseous Catheter Placement	165
Venipuncture	168
Tracheal Wash	169
Cloacal and Colonic Wash and Enema	170
Bandaging	170
Assist Feeding	171
Therapeutic Administration	172
Euthanasia	173
References	173

10 Snakes 177

<i>Ryan Cheek</i>	
Introduction	177
Behavior	177
Anatomy and Physiology	178
Integument	178
Musculoskeletal System	179
Cardiovascular System	180
The Heart	180
The Lymphatic System	181
Respiratory System	182
Nervous System	182
Sense Organs	182
Cutaneous Sense Organs	182
Ears	182
Smell	183
Vomeronasal Sense	183

Eyes	183
Digestive System	183
Urinary System	184
Endocrine and Exocrine Glands	184
Pituitary Gland	184
Pineal Complex	185
Thyroid Gland	185
Parathyroid Gland	185
Pancreas	185
Gonads	185
Adrenal Glands	185
Reproductive Biology and Husbandry	185
Male Anatomy	185
Female Anatomy	185
Sex Determination	185
Secondary Sexual Characteristics	186
Sexual Dimorphism	186
Manual Eversion	186
Cloacal Probing	186
Hydrostatic Eversion	186
Other Methods of Sex Determination	186
Fertilization	187
Sexual Maturity	187
Follicle Maturation and the Fat Cycle	187
Courtship	188
Oviparous, Ovoviviparous, and Viviparous	188
Egg Anatomy	188
Timing and Frequency of Reproduction	189
Maternal Care	189
Egg Incubation and Management	189
Artificial Incubation	189
Maternal Incubation	189
Incubator Design	189
Determining Egg Viability	190
Manual Pipping	190
Housing	190
Substrate	191
Heating and Lighting	193
Water and Humidity	196
Other Cage Furnishings	197
Quarantine	197
Nutrition	198
Prey Items	198
Why Will My Snake Not Eat?	200
Diseases and Clinical Conditions	201
Diseases Affecting the Reproductive Tract	201
Disorders of the Integument	203
Disorders of the Cardiovascular System	203
Disorders of the Nervous System	203
Disorders of the Respiratory Tract	204
Disorders of the Urinary System	204
Disorders of the Eye	204

Disorders of the Digestive System	205
Infectious Stomatitis	205
Vomiting and Regurgitation	205
Diagnosing Lumps and Bumps	205
Viral Diseases	205
Zoonotic Diseases	206
Taking a History	207
Signalment	207
Presenting Complaint	208
Husbandry and Nutritional Information	208
Previous Medical History	209
Preparing for the Physical Examination	209
Transportation	209
Restraint	209
The Physical Exam	213
Integument	213
Respiratory System	213
Cardiovascular System	213
Neurologic Examination	213
Palpations	214
Ophthalmic Exam	214
Fecal Exam	214
Oral Exam	214
Radiology	214
Positioning	214
Restraint	214
Anesthesia	215
Anatomy and Physiology Considerations	215
Pre-anesthetic Examination and Considerations	215
Pre-anesthetic Medications	215
Anticholinergics	215
Injectable Sedatives and Anesthetics	215
Inhalant Anesthetics	216
Analgesics	216
Recovery	218
Anesthetic Monitoring	218
Cardiovascular Monitoring	218
Respiratory Monitoring	218
Surgery	219
Wound Healing	219
Common Surgical Procedures	219
Parasitology	219
Diagnosing Parasites	219
Common Parasites of Snakes	220
External Parasites	220
Ticks	220
Mites	220
Internal Parasites	221
Protozoa	221
Cestodes	222
Nematodes	222
Blood Parasites	222
Preventing Parasites	222

Emergency and Critical Care	222
Phone Calls	222
Initial Presentation and History	223
Diagnostics	223
Treatment	223
Emergency Conditions	223
Trauma	223
Hypothermia	223
Hyperthermia	224
Dyspnea	224
Thermal Burns	224
Critical Care Monitoring	224
Clinical Techniques	224
Administration of Medications	224
Intravenous (IV)	224
Subcutaneous (SC)	224
Intramuscular (IM)	224
Intracoelomic (ICe)	225
Oral (PO)	225
Venipuncture	225
Tail Vein	225
Cardiocentesis	225
Palatine Vein	225
Intravenous Catheter Placement	226
Assist Feeding	226
Tracheal and Lung Wash	226
Colonic Wash and Enema	227
Venomous Snakes	227
Euthanasia	228
Being a Responsible Snake Owner	228
References	229

11 Chelonians 231

Sarah Camlic, Ryan Cheek, Pia Bartolini, and Samuel Rivera

Introduction	231
Anatomy and Physiology	232
Musculoskeletal System	232
Integument	233
Cardiovascular System	233
Respiratory System	233
Digestive System	234
Excretory System	234
Reproductive System	234
Nervous System	235
Sense Organs	236
Husbandry and Nutrition	236
Aquatic and Semi-aquatic Species	236
Tortoises and Terrestrial Turtles	238
Common Disorders	243
Integument	243
Skeletal System	244
Cardiovascular System	245

Respiratory System	245
Digestive System	246
Excretory System	247
Reproductive System	248
Nervous System	249
Toxicity, Nutritional, and Miscellaneous Disorders	249
Zoonoses	250
Parasitology	251
External Parasites	251
Internal Parasites	251
Protozoans	251
Helminths	251
Trematodes	251
Nematodes	251
Cestodes	252
Acanthocephalans	252
History, Restraint, and Physical Examination	252
History	252
Restraint	252
Physical Examination	254
Radiology	255
Anesthesia	256
Pre-anesthetic Considerations	256
Anesthetic Agents and Induction	257
Benzodiazepines	257
α -2 agonists	258
Opioids	258
Dissociatives	258
Propofol	258
Alfaxalone	258
Maintenance, Monitoring, and Recovery	258
Surgery	259
Clinical Techniques	260
Venipuncture	260
Jugular vein	260
Brachial vein	260
Subcarapacial venous sinus/vein	260
Dorsal coccygeal venous sinus/vein	261
Less common sites	261
Intravenous and Intraosseous Catheter Placement	262
Therapeutic Administration	263
Intramuscular route	263
Subcutaneous route	263
Intravenous/intraosseous route	264
Intracoelomic route	264
Epicoelomic route	264
Oral route	264
Cloacal route	264
Topical route	265
Nebulization	265
Miscellaneous Clinical Techniques	265
Wound care	265

Fecal examination	265
Cloacal and colonic wash and enema	266
Respiratory tract sampling	266
Emergency and Critical Care	266
Euthanasia	267
References	268

12 Herpetoculture and Reproduction 273

<i>David Martinez-Jimenez</i>	
Introduction	273
Basic Principles for Breeding and Care	273
Stock Selection	273
Understanding Genetics	274
Physical Examination and Sexing	274
Sexual Dimorphism	274
Probing	275
Manual Eversion of Hemipenes (Popping)	276
Hydrostatic Eversion of Hemipenes	276
Digital Palpation	276
Plasma Testosterone	276
Morphometrics	276
DNA Sexing	276
Ultrasonography and Laparoscopy	276
Record Keeping and Size of the Collection	277
Quarantine	277
Collection Management and Housing	278
Managing Large Collections	278
Managing Large Collections of Dangerous Species	280
Nutrition	283
Feeding the Neonate	284
Breeding Management	284
Reproductive Behavior	284
Courtship and Mating Behavior	285
Reproduction Without Mating	285
Clutch Dynamics	286
Oviparous, Ovoviviparous, or Viviparous; and Parthenogenesis	286
Egg Incubation Versus Maternal Incubation	287
Egg Incubation Methods	288
Temperature	289
Substrate	289
Humidity	289
Caring for the Newborn	290
Medical Problems Arising from Reproduction	291
Diagnosing Egg Problems	291
Genetic Related Diseases	292
Common Reproductive Diseases	295
References	295

13 Infectious Diseases of Reptiles 297

<i>Pia Bartolini</i>	
Introduction	297
Biosecurity and Quarantine	298

Sample Collection, Diagnostic Testing, and Shipping	298
Infectious Diseases	301
Bacterial	301
Fungal	304
Parasitic	306
Viral	309
References	317

Section V Amphibians and Aquatic Animals 321

14 Amphibians 323

Brad Wilson

Introduction, Taxonomy, and Natural History	323
Taxonomy	323
Anatomy and Physiology	328
Integument	328
Skeletal System	329
Digestive System	330
Respiratory System	330
Excretory System	331
Reproductive System	331
Cardiovascular System	332
Nervous System	332
Sense Organs	332
Husbandry	332
Enclosures and Environment	333
Enclosure Design	336
The Terrestrial Enclosure	336
The Aquatic Enclosure	337
Amphibian-Environment Interaction	338
Amphibian-Amphibian Interaction	338
Quarantine	339
Nutrition	340
Food Items	341
Common Disorders	342
Anorexia	343
Weight Loss	344
Activity or Behavior Disturbance	344
Dysecdysis or Excessive Skin Shedding	344
Dehydration	345
Seizures/Paralysis/Weakness	345
Cloacal Prolapse	346
Gastrointestinal Foreign Body Obstruction	346
Trauma and Cutaneous Injury	346
Infectious Skin Diseases: Bacterial Dermatitis	348
Infectious Skin Diseases: Chytridiomycosis	349
Miscellaneous Skin Diseases	350
Nutritional Disorders: Nutritional Secondary Hyperparathyroidism	350
Nutritional Disorders: Hypovitaminosis A	351
Nutritional Disorders: Lipid Keratopathy	352
Nutritional Disorders: Spindly Leg Syndrome	352

- Parasitism 353
- Bloating 354
- Toxicity 355
- Zoonoses 355
- Larval Amphibians 356
- History, Restraint and Physical Examination 356
 - History 356
 - Restraint 357
 - Physical Examination 358
- Radiology 359
- Anesthesia and Surgery 360
 - Anesthesia 360
 - Surgery 362
- Techniques 362
 - Venipuncture 362
 - Celiocentesis 362
 - Fecal Examination 363
 - Cloacal Wash 363
 - Transtracheal Wash 363
 - Skin Scrape and Impression Smear 364
 - Assist Feeding 364
 - Therapeutic Administration 364
- Euthanasia 365
- References 365

15 Fish 369

- Sandy Skeba and Bonnie Ballard*
- Natural History 369
 - History 370
- Anatomy and Physiology 370
 - Basic Body Shapes 370
 - Integumentary System 370
 - Fins 370
 - Osmoregulation 371
 - Senses 371
 - Sight 371
 - Sound 371
 - Taste/Smell 372
 - Proprioception 372
 - Respiratory System 372
 - Cardiovascular System 373
 - Gastrointestinal System 373
 - Urogenital System 373
- Husbandry 374
 - Water Quality 376
 - pH 377
 - Oxygen 379
 - Temperature 379
 - Chlorine and Chloramine 379
 - Salinity 380
 - Planted Tanks 380
 - Feeding 380

Quarantine	381
Common Diseases of Aquarium Fish	381
Ammonia or Nitrite Poisoning	381
Hypoxia	381
Fungal Infections	381
Dropsy	381
Egg Binding	382
Color Change	382
Ragged Fins	382
Ulcerations	382
Mycobacteriosis	382
Lateral Line Disease/Hole-in-the-Head	382
Scoliosis	382
Swim Bladder Disease	382
Gas Bubble Disease	382
Exophthalmos	383
Lymphocystis	383
Parasitology	383
Flagellates	383
Ciliates	384
Trematodes	385
Nematodes	386
Cestodes	386
Crustaceans	386
Physical Examination	387
Restraint	387
Chemical Restraint/Anesthesia	387
Analgesia	388
Surgery/Wound Healing	389
Radiology	389
Basic Diagnostics	390
Venipuncture	391
Injections	392
Transportation	392
Euthanasia	392
Necropsy	393
References	396

Section VI Exotic Companion Mammals 397

16 Ferrets 399

Colleen Roman

Introduction 399

Anatomy 399

 Conformation 399

 Skin and Hair Coat 399

 Skeletal System 399

 Digestive Tract 399

 Heart and Lungs 400

 Spleen 400

 Urogenital Tract 400

Adrenal Glands	400
Biologic and Reproductive Data	401
Behavior	401
Husbandry	402
Nutrition	403
Common Diseases	404
Zoonotic Diseases	405
History and Physical Examination	405
Anxiety and Stress-free Techniques	407
Considerate Approach, Gentle Control, and Touch Gradient	407
Plan of Action	407
Preventive Medicine	408
Restraint	409
Radiology and Ultrasound	410
Anesthesia and Surgery	410
Parasitology	410
Urinalysis	411
Emergency and Critical Care	412
Sex Determination	413
Clinical Techniques	413
Nail Trimming	413
Urine Collection	413
Cystocentesis	413
Urinary Catheterization	413
Temperature, Pulse, and Respiration	414
Medication Administration	414
Venipuncture	414
Jugular Vein	414
Cephalic Vein	414
Saphenous Vein	414
Cranial Vena Cava	415
Intravenous Catheter Placement	415
Intraosseous Catheter Placement	416
Enema	416
Bandage and Wound Care	416
Blood Transfusion	416
Dental Prophylaxis	417
Euthanasia	417
References	418

17 Rabbits 421

Vanessa K. Lee, Douglas K. Taylor, and Deborah Mook

Introduction	421
Behavior and Reproduction	421
Anatomy and Physiology	422
Laboratory and Biological Data	424
Husbandry	426
Nutrition	426
Common and Zoonotic Diseases	427
Respiratory Infectious Diseases	427
Diseases of the Digestive System	428
Integumentary Infectious Diseases	430

Zoonotic Infectious Diseases	432
Other Infectious Diseases	433
Inherited Diseases	433
Skeletal, Traumatic, Idiopathic, and Environmental Diseases	434
Neoplasia	435
Taking a History	436
Physical Examination and Preventive Medicine	436
Handling and Restraint	440
Imaging	441
Anesthesia	442
Pre-anesthesia	442
Anesthetic Agents Used in Rabbits	442
Perioperative Considerations	446
Anesthesia Monitoring	446
Post-anesthetic Care	447
Pain Assessment and Management	447
Common Surgical Procedures	450
Clinical Techniques	450
Analgesia for Clinical Procedures	450
Blood Collection	451
Placing a Catheter	452
Urinalysis	452
Parasitology	452
Administration of Medications	452
Intravenous Injection	452
Subcutaneous Injection	452
Intraperitoneal Injection	453
Intramuscular Injection	453
Intraosseous Infusion	454
Medication per os	454
Teeth Trimming	454
Nail Trimming	454
Assist Feeding	455
Sex Determination	455
Emergency and Critical Care	455
Euthanasia	457
References	457

18 Mice, Rats, Gerbils, and Hamsters 465

<i>April Romagnano</i>	
Introduction	465
Anatomy and Physiology	465
Biologic and Reproductive Data	466
Husbandry	467
Nutrition	468
Common Parasites, Diseases, and Zoonoses	468
To Perform the Cellophane Tape Test	469
Behavior	471
History and Physical Examination	472
Restraint and Handling	472
To Handle Gerbils, Mice, and Rats	473
To Handle a Hamster	473
Radiology	473

Surgery, Anesthesia, and Pain Management	473
Bandaging and Wound Care	476
Emergency and Critical Care	477
Sex Determination	477
Clinical Techniques	477
Administration of Medications	477
Intravenous Injection	477
Intramuscular Injection	478
Intraperitoneal Injection	478
Subcutaneous Injection	478
Oral Administration	479
Gavaging	479
Blood Collection	479
Euthanasia	480
Acknowledgment	481
Additional Reading	481

19 Chinchillas 483

<i>Ashley McGaha</i>	
Taxonomy/Common Species Seen in Practice	483
Anatomy and Physiology	483
External Anatomy	483
Digestive Tract	483
Liver	484
Pancreas	484
Spleen	484
Respiratory Tract	484
Reproductive Organs	484
Urinary Tract	485
Anal Sacs	485
Reproduction	485
Husbandry	485
Nutrition	485
Common and Zoonotic Diseases	485
Dental Diseases	485
Skin Diseases	486
Gastrointestinal Diseases	486
Respiratory Diseases	487
Neurologic Diseases	487
Penile Disorders	487
Heat Stroke	487
Zoonotic Diseases	487
Behavior	487
Taking the History and Performing the Physical Examination	487
Handling and Restraint	488
Radiology	489
Anesthesia and Surgery	489
Parasitology	489
Urinalysis	489
Emergency and Critical Care	490
Sex Determination	490
Clinical Techniques	490

Venipuncture	490
Intravenous Catheter Placement	490
Intraosseous Catheter Placement	490
Administration of Medication	491
Euthanasia	491
References	491

20 Guinea Pigs 493

<i>Liz Vetrano</i>	
Introduction	493
Common Types	493
Anatomy and Physiology	493
Sex Determination	494
Behavior	494
Biologic and Reproductive Data	495
Husbandry	495
Nutrition	496
History and Physical Examination	497
Restraint	498
Radiology	498
Hematology	498
Anesthesia, Surgery, and Analgesia	499
Urinalysis	500
Emergency and Critical Care	500
Common and Zoonotic Diseases	501
Gastrointestinal	501
Gastrointestinal Hypomotility	501
Gastric Dilation and Volvulus	501
Gastrointestinal Dysbiosis	502
Fecal Impaction	502
Dental Disease	502
Reproductive Disease	502
Dystocia	502
Pregnancy Ketosis	502
Ovarian Cysts and Neoplasia	502
Respiratory Disease	503
Urinary Diseases	503
Urolithiasis	503
Cystitis and Urinary Tract Infections	503
Integumentary	503
Alopecia	503
Dermatophytosis	503
Pododermatitis	503
Ectoparasites	504
Musculoskeletal	504
Osteoarthritis	504
Vitamin C Deficiency	504
Other Common Diseases	505
Cervical Lymphadenitis	505
Clinical Techniques	505
Administration of Medication	505
Subcutaneous (SC or SQ)	505

- Intramuscular (IM) 505
- Intravenous (IV) 506
- Venipuncture 506
- Catheter Placement 507
- Bandaging and Wound Care 508
- Euthanasia 508
- References 509

21 Degus 511

Stacey Leonatti Wilkinson

- Introduction 511
- Anatomy and Physiology 511
- Behavior 511
- Biologic and Reproductive Data 512
- Husbandry 513
- Nutrition 513
- Restraint and Handling 513
- Common Diseases 514
- History and Physical Examination 515
- Hematology 515
- Radiology 515
- Anesthesia and Surgery 515
- Parasitology 516
- Emergency and Critical Care 516
- Clinical Techniques 516
 - Administration of Medication 516
 - Oral (PO) 516
 - Subcutaneous (SC) 516
 - Intramuscular (IM) 517
 - Intraperitoneal (IP) 517
 - Intravenous (IV) 517
 - Catheter Placement 517
 - Wound Management 517
- Euthanasia 517
- References 518

22 Hedgehogs 519

Ashley McGaha

- Taxonomy, Anatomy, and Physiology 519
- Biologic and Reproductive Data 519
- Behavior 520
- Husbandry 522
- Nutrition 523
- Common Diseases 523
 - Lameness 523
 - Anorexia 523
 - Diarrhea 523
 - Dermatologic Problems 523
 - Neurological Problems 523
 - Ophthalmologic Trauma 524
 - Liver Disease 524
 - Urinary Disease 524

Internal Parasites	524
Respiratory Disease	524
Neoplasia	524
Obtaining a History and Physical Examination	524
Radiology	525
Anesthesia, Analgesia, and Surgery	525
Urinalysis	525
Parasitology	526
Emergency and Critical Care	526
Clinical Techniques	526
Venipuncture	526
TPR	526
Urine Collection	527
Administration of Medications	527
Bandaging and Wound Care	528
Euthanasia	528
References	528

23 Skunks 529

<i>Serina Scott and Samuel Rivera</i>	
Introduction	529
Anatomy and Physiology	529
Biologic Data	529
Husbandry and Nutrition	529
Common Health Problems	530
Obesity	530
Hepatic Lipidosis	530
Cardiomyopathy	530
Dental Disease	530
Dermatitis	531
Canine Distemper	531
Feline Panleukopenia	531
Aleutian Disease	531
Zoonotic Diseases	531
Physical Examination	531
Vaccinations	531
Restraint	531
Radiology	532
Anesthesia/Analgesia	532
Parasitology	532
Clinical Techniques	532
Blood Collection	532
Jugular Vein	532
Cephalic Vein	533
Lateral Saphenous Vein	533
Femoral Vein	533
IV Catheter Placement	533
Urine Collection	533
Fecal Analysis	534
Administration of Medications	534
Euthanasia	534
References	534

- 24 Sugar Gliders** 535
Nia Chau and Samuel Rivera
Introduction and Natural History 535
Anatomy 535
 Biologic Data 536
Husbandry and Nutrition 536
Common Diseases 536
 Nutritional Osteodystrophy 536
 Enteritis 538
 Trauma 538
 Dental Disease 538
 Obesity 538
 Stress-related Disease 538
 Rectal Prolapse 538
 Penile Prolapse and/or Self-mutilation 539
 Neoplasia 539
 Malnutrition 539
Physical Examination 539
Restraint 539
Radiology 540
Anesthesia and Analgesia 541
Surgery 542
Parasitology 542
Clinical Techniques 542
 Blood Collection 542
 Urine Collection 544
 Fecal Analysis 544
 Subcutaneous Fluid Administration 544
 Intramuscular Injections 544
Euthanasia 545
References 545
- 25 Prairie Dogs** 547
Stacey Leonatti Wilkinson and Samuel Rivera
Introduction 547
Anatomy and Physiology 547
 Biologic Data 547
Behavior 547
Husbandry and Nutrition 547
Common and Zoonotic Diseases 548
 Barbering 548
 Obesity 548
 Nasal Dermatitis 548
 Dermatomycosis (Ringworm) 549
 Respiratory Disease 549
 Elodontomas 549
 Heart Disease 549
 Pododermatitis (Bumblefoot) 550
 Zoonotic Diseases 550
Restraint 550
Radiology 551
Anesthesia and Analgesia 551

Clinical Techniques	551
Venipuncture	551
Urine Collection	552
Fecal Analysis	552
Administration of Medications	552
Euthanasia	552
References and Further Reading	553

26 Critical Care Feeding 555

<i>Micah Kohles</i>	
Introduction	555
What is Critical Care/Recovery Feeding?	555
When to Assist Feed	556
Approaches to Critical Care Feeding	557
How Much to Feed?	558
How Long to Assist Feed	559
What About Hydration?	559
Rabbits	559
Guinea Pigs	559
Hamster/Gerbils	559
Ferrets	560
References	560
Additional Reading	560

Section VII Hematology 561

27 Avian and Reptile Hematology 563

<i>Denise I. Bounous</i>	
Introduction	563
Blood Collection	563
Blood Smear and Assessment	564
Leukocytes	564
Total Leukocyte Count	564
Heterophils	564
Eosinophils	565
Basophils	566
Lymphocytes	566
Monocytes	566
Azurophils	567
Erythrocytes	567
Thrombocytes	568
References	568

Section VIII Zoo, Aquarium Medicine, and Wildlife 569

28 The Role of a Veterinary Technician in a Zoo 571

<i>Sandy Skeba</i>	
Typical Day	571
How Does a Zoo Differ From Private Practice?	572
Zoo Veterinary Hospitals By Section	574

- Treatment 574
- Surgery 574
- Radiology 575
- Quarantine 576
- Intensive Care 577
- Nursery 577
- Laboratory 578
- Pharmacy 579
- Necropsy 580

- Do You Have What It Takes to Be a Zoo Veterinary Technician? 583
- Job Description for a Zoo Veterinary Technician 584
- How Do You Become a Zoo Veterinary Technician? 585
- Reference 585

29 The Role of a Veterinary Technician at a Public Aquarium 587

Rachel Parchem

- Introduction 587
- Typical Day 587
- How Does an Aquarium Differ from Private Practice? 588
- Challenges of Large, Multispecies Habitats 591
- Marine Mammal Medicine 592
- Do You Have What it Takes to Become an Aquarium Veterinary Technician? 593
- Job Description for an Aquarium Veterinary Technician 593

30 The Role of the Veterinary Technician in Wildlife Rehabilitation 595

Melanie Haire

- Introduction 595
 - Getting Started 595
- Rehabilitating Wildlife in a Small Animal Veterinary Hospital 596
- Clinic Protocols 596
 - Selecting Types of Wildlife to Care For 596
 - Stabilization or Long-term Rehabilitation—An Important Decision 597
 - Euthanasia 597
 - Phone Protocols 597
 - Handling Phone Calls 598
 - Baby Songbirds 598
 - Baby Raptors 598
 - Baby Squirrels 598
 - Baby Rabbits 598
 - Baby Opossums 599
 - Baby Deer 599
 - Baby Raccoons 599
- Intake Procedures 599
- Ethical Considerations and Reducing Stress in Captive Wildlife 600
- Initial Exam 600
- Choosing Treatment Routes 601
- Release Criteria Versus Euthanasia 601
- Imprinting and Taming 603
 - Imprinting 603
 - Taming 603
- Transporting Wildlife 603
 - Adult Birds 604

Baby Birds	604
Adult Mammals	604
Mammals	605
Turtles	605
Snakes	605
Raptor Care	605
Raptor Handling	605
Raptor Initial Exam	606
Raptor Caging	607
Raptor Feeding	608
Raptor Orphan Initial Care	609
Raptor Orphan Feeding	610
Raptor Orphan Food	610
Raptor Orphan Housing	611
Altricial Orphan Songbirds Basic Care	611
Development	611
Initial Care	611
Identification	612
Housing Nestlings	612
Housing Fledglings	613
Feeding Methods	613
Pigeon and Dove Feeder	614
Food Prep	614
Feeding Frequency	615
Diets	615
Additional Information	615
Caring for Adult Passerine (Song) Birds	616
Initial Care	616
Immobilizing Fractures	617
Housing Adult Birds	618
Feeding Adult Birds	618
Precocial Bird Basic Care	619
Initial Orphan Care	619
Identification	619
Housing	619
Feeding	620
Adult Precocial Birds (Including Waterfowl and Wading Birds)	620
Housing	620
Feeding	621
General Orphan Mammal Care	621
What to Do First	621
Introducing Formula	621
Preparing Formulas	621
Selecting Milk Formulas	622
Syringe Feeding	622
Other Feeding Implements	623
Feeding Procedure	624
Orphan Mammal Housing	624
Species Care Sheets	625
Acknowledgments	625
References	626
Additional Reading	626

Section IX Appendices 627**Appendix 1 State/Federal Wildlife Permit Offices 629**

State and U.S. Territory Wildlife Permit Offices 629

United States Migratory Bird Permit Offices 630

Appendix 2 Wildlife Admissions/Exam/Care Forms 633**Appendix 3 Handling and Restraint of Wildlife Species 637***Florina S. Tseng DVM*

Introduction 637

Considerations 637

Preparation 638

Tools of Restraint 638

Specific Techniques by Species 639

Opossums 639

Rabbits 639

Rodents 639

Carnivores 640

Hoofed Stock 640

Birds 640

Reptiles and Amphibians 641

Snakes 641

Amphibians 641

Conclusion 641

Reference 641

Appendix 4 Tail Wrapping 643**Appendix 5 Guide to Identification of Hatchling and Nestling Songbirds 645****Appendix 6 Average Body Weights of Selected North American Songbirds 649****Appendix 7 Species Care Sheets 651**

Raccoons 651

Raccoon Diet and Feeding 651

Raccoon Housing 651

Raccoon Release 652

Flying Squirrels 652

Flying Squirrel Diet and Feeding 652

Flying Squirrel Housing 652

Flying Squirrel Release 653

Flying Squirrel Miscellaneous Information 653

Opossums 653

Opossum Diet and Feeding 653

Opossum Housing 653

Opossum Release 654

Opossum Miscellaneous Information 654

Grey Squirrels 654

Grey Squirrel Diet and Feeding 654

Grey Squirrel Housing 654

Grey Squirrel Release 655

Cottontail Rabbits	655
Cottontail Rabbit Diet and Feeding	655
Cottontail Rabbit Housing	655
Cottontail Rabbit Release	656
Appendix 8 Biological Data of Selected North American Wild Mammals	659
Appendix 9 Glossary of Medical Conditions and Treatments	661
Appendix 10 Wildlife Product Sources	665
Product Sources	665
Appendix 11 Additional Resources	669
Natural History: General	669
Birds	669
Rodents	669
Lagomorphs	669
Opossum	670
Canids	670
Mustelids	670
Procyons	670
Wildlife Rehabilitation Organizations	670
Rehabilitation Books and Manuals	670
General Rehabilitation Topics	670
Mammal Rehabilitation	671
Avian Rehabilitation	671
Wildlife Veterinary Topics	671
Web Sites Useful to Rehabilitators	671
Appendix 12 Supplies Necessary for an Exotic Practice	673
Appendix 13 Animal Training Documentation	675
Appendix 14 Animal Data Transfer Form	677
Appendix 15 Operating Protocols: Animal Training Request Form	683
Appendix 16 Operating Protocols: Enrichment and Evaluation Form	685
Index	687

