

SECOND EDITION



Enhanced
**DIGITAL
VERSION**
Included

The Cat

CLINICAL MEDICINE and MANAGEMENT

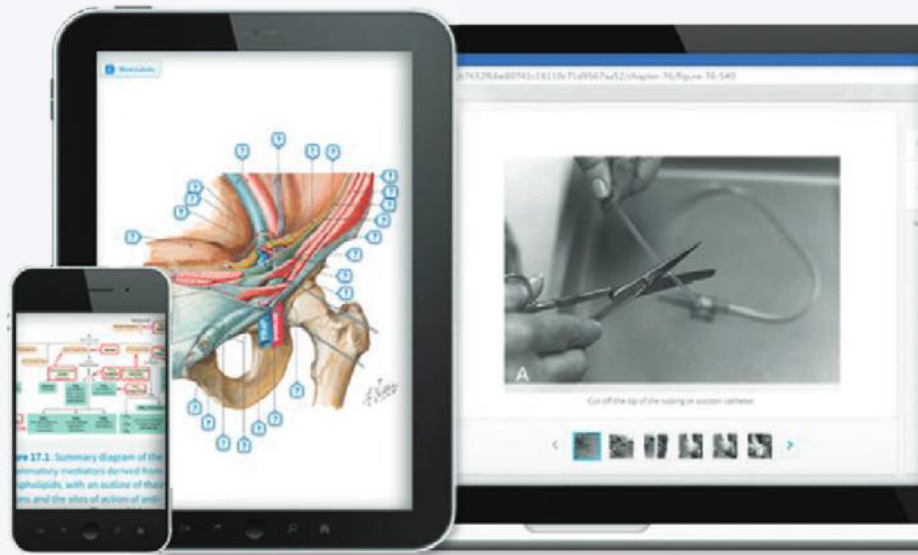


Susan E. Little



Any screen. Any time. Anywhere.

Activate the eBook version
of this title at no additional charge.



Elsevier eBooks+ gives you the power to browse, search, and customize your content, make notes and highlights, and have content read aloud.

Unlock your eBook today.

1. Visit <http://ebooks.health.elsevier.com/>
2. Log in or Sign up
3. Scratch box below to reveal your code
4. Type your access code into the “Redeem Access Code” box
5. Click “Redeem”

It's that easy!

For technical assistance:
email textbookscom.support@elsevier.com
call 1-800-545-2522 (inside the US)
call +44 1 865 844 640 (outside the US)

Place Peel Off
Sticker Here

Use of the current edition of the electronic version of this book (eBook) is subject to the terms of the nontransferable, limited license granted on <http://ebooks.health.elsevier.com/>. Access to the eBook is limited to the first individual who redeems the PIN, located on the inside cover of this book, at <http://ebooks.health.elsevier.com/> and may not be transferred to another party by resale, lending, or other means.

2022v1.0

SECOND EDITION

The Cat

CLINICAL MEDICINE and MANAGEMENT



Susan E. Little, DVM, DABVP (Feline Practice)

Bytown Cat Hospital

Ottawa, Ontario, Canada



Contents

I

FUNDAMENTALS OF FELINE PRACTICE

1. Understanding the Cat and Feline-Friendly Handling, 2

Ilona Rodan

- Introduction, 2
- Who is the Cat?, 2
- How Cats Perceive the World, 4
- How Each Cat is an Individual, 5
- Cat Communication, 7
- Causes of Distress in Cats, 9
- How Cats Respond to Stressors, 10
- Feline-Friendly Handling: Preventing Stressors Associated with Veterinary Visits, 14
- Hospitalization and Housing Feline Patients, 31
- Summary, 36

2. The Cat-Friendly Practice, 37

Jane E. Brunt

- Introduction, 37
- What is a Feline Veterinarian?, 38
- Foundations of a Cat-Friendly Practice, 38
- Physical Features of a Cat-Friendly Practice, 38
- Conclusion, 43

3. Deciphering the Cat: The Medical History and Physical Examination, 45

Vicki Thayer

- Introduction, 45
- Establishing Relationship-Centered Care, 45
- The Medical History, 45
- The Physical Examination, 51
- Moving to Adherence From Compliance, 60

4. Guidelines and Precautions for Drug Therapy in Cats, 64

Lauren A. Trepanier

- Introduction, 64
- Differences in Drug Metabolism in Cats, 64
- Therapeutic Considerations in Neonates and Kittens, 65
- Therapeutic Considerations in Senior and Geriatric Cats, 66
- Dosage Guidance in Renal Disease, 67
- Dosing Considerations in Hepatic Insufficiency, 69

- Alternative Drug Formulations for Cats, 70
- “Ad Hoc” Drug Reformulations, 71
- Compounding and Transdermal Drugs, 72
- Summary, 74

5. Fluid Therapy, 75

Nancy Sanders, Anthony S. Johnson, and Katherine M. James

- Introduction, 75
- Body Fluid Balance, 75
- Steady State and the Concept of Maintenance, 75
- Body Fluid Compartments, 76
- Perfusion, 78
- Salt Balance: Disorders of Extracellular Fluid Volume, 78
- Water Balance: Disorders of Sodium Concentration, 79
- Understanding Fluid Losses, 80
- Body Response to Hypovolemia, 83
- General Considerations for Fluid Therapy, 83
- Fluid Types, 84
- Routes of Administration, 93
- Fluid Therapy Plans and Monitoring, 94
- Intravenous Fluids During Anesthesia, 103
- Fluid Therapy for Specific Conditions, 103
- Summary, 111

6. Assessment and Management of Pain, 113

Analgesia, 113

Carolyn McKune and Sheilah A. Robertson

- Pain Recognition and Assessment, 114
- Routes and Methods of Drug Administration, 120
- Analgesic Drugs, 123
- Local Anesthetic Agents, 131
- Multimodal Analgesia, 137
- “Send Home” Medications, 137
- Individual Variation in Response to Analgesic Drugs, 138
- Special Populations, 138
- Other Analgesic Modalities, 139
- Conclusion, 139

Chronic Pain, 140

Beatriz P. Monteiro and Paulo Steagall

- Introduction, 140
- Prevalence, 140
- Risk Factors, 140
- Medical History Findings, 141
- Physical Examination Findings, 142

Clinical Signs, 142
 Relevant Physiology and Anatomy, 142
 Diagnostic Testing, 143
 Therapeutic Options, 145
 Prognosis, 154
 Owner Education, 154
 Specific Chronic Painful Conditions, 154
 Summary, 159

7. Principles of Anesthesia, 160

Drugs and Techniques in Feline Anesthesia, 160

Bruno H. Pypendop and Jan E. Ilkiw

Assessment of Risk, 160
 Sedation and Premedication, 161
 Intubation, 176
 Maintenance of Anesthesia, 177
 Anesthetic Considerations for Special Conditions, 186
 Summary, 197

Special Considerations in Feline Anesthesia, 198

Sheilah A. Robertson

Introduction, 198
 The Risks of Feline Anesthesia, 198
 Morbidity, Adverse Events, and Errors in Feline Anesthesia, 199
 Decreasing the Risks of Anesthesia, 203
 Summary, 209

8. Preventive Health Care for Cats, 210

Ilona Rodan and Andrew Sparkes

Introduction, 210
 The Benefits of Feline Preventive Health Care, 210
 Current Barriers to Feline Preventive Health Care, 211
 Feline Life Stage Preventive Health Care, 213
 Components of a Comprehensive Feline Preventive Health Care Program, 213
 Client Communication and Resources, 235
 Summary, 237

9. Clinical Pathology, 238

Randolph M. Baral and Kathleen P. Freeman

Introduction, 238
 Blood Test Interpretation Overview, 238
 Interpretation of Specific Conditions, 240
 Hematology and Coagulation Interpretation, 262
 Urinalysis Interpretation, 262
 Cytology Interpretation, 264
 Commercial Versus In-House Laboratory, 267
 General Principles of Quality Assurance and Quality Control, 271
 Summary, 276

10. Essential Emergency and Critical Care Techniques, 277

Kenneth J. Drobatz and Nicole Cilli

Introduction, 277
 Oxygen Supplementation, 277
 Arterial Blood Gas Sampling, 278
 FAST Scan, 280
 Centesis Procedures and Chest Tubes, 282
 Urethral Obstruction Procedures, 286
 Venous Cutdown, 288
 Intraosseous Catheterization, 288
 Summary, 289

11. Chronic Disease Management, 290

Therapeutic Immunosuppression, 290

Kristin M. Lewis and Leah A. Cohn

Introduction, 290
 Immunosuppressive Drug Therapy, 291
 Monitoring Long-Term Therapy, 296

Melissa Clark

Introduction, 296
 Clinical and Clinicopathologic Monitoring, 296
 Pharmacodynamic Monitoring of Drugs With Objective Measures of Efficacy, 299
 Pharmacokinetic Monitoring, 302
 Summary, 305

Managing Adverse Reactions to Therapy, 306

Sidonie Lavergne

Introduction, 306
 Classification of Adverse Drug Reactions and Their Pathogenesis, 306
 Preventing Adverse Drug Reactions, 307
 Diagnosis of Adverse Drug Reactions, 307
 Therapeutic Management of Adverse Drug Reactions, 308
 The Aftermath of an Adverse Drug Reaction, 309
 Summary, 309

Palliative Medicine, Quality of Life, and Euthanasia Decisions, 310

Margie Scherk and Bernard E. Rollin

Introduction, 310
 Providing Support for the Function of Cells and the Organs, 310
 Alleviating Discomfort and Optimizing Comfort, 313
 Caring for the Caregivers, 318
 Conclusion, 318

II

FELINE BEHAVIOR

12. Kitten Development, 320

Gary Landsberg and Jacqueline Mary Ley

Introduction, 320
 Influence of Parental Factors on Behavioral Development, 320

Behavioral Development, 321
 Specific Behavior Patterns, 324
 Learning, 326
 Socialization and The Kitten, 327
 Summary, 328

13. Normal Behavior of Cats, 329

Jacqueline Mary Ley and Kersti Seksel

Introduction, 329
 The Biology of Cats, 329
 Sense Organs, 329
 Communication, 331
 Learning, 333
 Hunting and Feeding, 333
 Grooming, 333
 Social Organization and Density, 334
 Time Budgets: What do Cats do all Day?, 335
 Summary, 335

14. Kitten Socialization and Training Classes, 336

Kersti Seksel and Steve Dale

Introduction, 336
 Getting Started, 338
 Teaching Kittens, 340
 Class Structure, 340
 Topics to Cover, 340
 Summary, 342

15. Behavioral History Taking, 343

Debbie Calnon

Introduction, 343
 It's Not Just About the Cat, 343
 Empathy, 343
 Counseling Skills, 344
 Organizing a Consultation, 344
 Basic Patient Information, 346
 Self-Maintenance Behaviors, 347
 Social Environment, 347
 The Problem Behaviors, 347
 Formulating a Treatment Plan, 348
 Summary, 348

16. Behavior Problems, 349

Kersti Seksel

Introduction, 349
 Anxiety, Fear, and Phobia, 350
 Anxiety-Related Disorders, 351
 Aggression, 358
 Onychectomy and Behavior, 366
 Summary, 367

17. Behavioral Therapeutics, 368

Kersti Seksel, Gary Landsberg, and Jacqueline Mary Ley

Introduction, 368
 Behavior Modification, 368

Environmental Management, 370
 Psychotropic Medications, 373
 Natural Products, 377
 Summary, 378

III

FELINE NUTRITION

18. The Unique Nutritional Requirements of the Cat: A Strict Carnivore, 380

*Angela Witzel-Rollins, Joseph W. Bartges, Beth Hamper,
 Maryanne Murphy, and Donna Raditic*

Anatomy and Physiology, 380
 Feeding Behavior, 381
 Specific Nutrients, 382
 Conclusion, 386

19. Nutrition for the Normal Cat, 387

*Angela Witzel-Rollins, Joseph W. Bartges, Claudia Kirk,
 Beth Hamper, Maryanne Murphy, and Donna Raditic*

Normal Feeding Behavior, 387
 Carnivorous Adaptations, 388
 Energy Needs, 388
 Life Stage Nutrition, 389
 Senior and Geriatric Cats, 391
 Summary, 391

20. Nutritional Disorders, 392

*Joseph W. Bartges, Martha Cline, Donna Raditic, Angela
 Witzel-Rollins, Beth Hamper, and Maryanne Murphy*

Introduction, 392
 Food Components, 392
 Food Contaminants, 397
 Food Hypersensitivity and Intolerance, 397
 Summary, 400

21. Nutritional Management of Diseases, 401

*Joseph W. Bartges, Donna Raditic, Beth Hamper,
 Martha Cline, Maryanne Murphy, and
 Angela Witzel-Rollins*

Introduction, 401
 Cardiovascular Disease, 402
 Dental and Oral Disease, 404
 Dermatologic Disease, 405
 Endocrinologic Disease, 406
 Gastrointestinal Disease, 412
 Hepatic Disease, 413
 Musculoskeletal Disease, 414
 Oncologic Disease, 414
 Ophthalmologic Disease, 415
 Pulmonary and Thoracic Disease, 416
 Toxicologic Disease, 416

Urinary Tract Disease, 418
 Critical Care, 423
 Summary, 431

22. Current Controversies in Feline Nutrition, 432

Martha Cline, Maryanne Murphy, Joseph W. Bartges, Angela Witzel-Rollins, Beth Hamper, and Donna Raditic

Introduction, 432
 Chronic Kidney Disease and Reduced Dietary Protein, 432
 Cats and Carbohydrates, 434
 Homemade Diets, 438
 Raw Food Diets, 440
 Summary, 444

IV

FELINE INTERNAL MEDICINE

23. Cardiovascular Diseases, 446

Cardiac Diseases, 446

Geri Lake-Bakaar

Prevalence and Risk Factors, 446
 History and Physical Examination, 447
 Diagnosis of Feline Heart Disease, 449
 Cardiomyopathies, 453
 Arrhythmias, 462
 Congenital Heart Disease, 465
 Miscellaneous Heart Diseases, 468
 Summary, 469

Hypertension, 470

Beate Egner

General Considerations, 470
 Definition of Hypertension, 470
 Blood Pressure Regulation, 471
 Causes of Hypertension, 472
 Clinical Signs, 474
 Diagnosis, 475
 Treatment, 478
 Monitoring, 480
 Summary, 480

24. Dental and Oral Diseases, 481

Alexander M. Reiter and Maria M. Soltero-Rivera

Introduction, 481
 Oral Anatomy, 481
 Oral Examination, 487
 Diagnostic Imaging, 490
 Local and Regional Anesthesia, 492
 Periodontal Disease, 494
 Tooth Resorption, 496
 Dentoalveolar Trauma, 500
 Stomatitis, 503
 Tooth Extraction, 505

Eosinophilic Granuloma Complex, 507
 Feline Orofacial Pain Syndrome, 509
 Palate Defects, 510
 Orofacial Soft Tissue Injury, 512
 Jaw Fractures, 513
 Temporomandibular Joint Disorders, 517
 Oral and Maxillofacial Tumors, 519
 Summary, 522

25. Dermatology, 523

Feline Skin Diseases, 523

Karen A. Moriello and Elizabeth A. Layne

What are the Most Common Skin Diseases of Cats?, 523
 Diagnostic Approach, 523
 Pruritus, 531
 Eosinophilic Lesions, 542
 Alopecia, 545
 Scaling, Crusting, and Greasy Skin, 547
 Chin Acne and Chin Furunculosis, 554
 Ulcers and Erosions, 555
 Fragile Skin, 555
 Hard Skin, 556
 Pigmentary Changes, 556
 Diseases of Paw Pads, Paronychia, and Anal Sacs, 557
 Otitis, 559
 Nonhealing Wounds, 564
 Summary, 565
Human Allergies To Cats, 566
Daniel O. Morris
 General Information, 566
 Mitigation Strategies, 567
 Summary, 569

26. Digestive System, Liver, and Abdominal Cavity, 570

Approach to the Vomiting Cat, 571

Randolph M. Baral

Introduction, 571
 Step 1: Signalment and Clinical History, 572
 Step 2: Physical Examination, 572
 Step 3: Blood and Urine Testing, 574
 Step 4: Imaging, 575
 Step 5: Biopsies, 575
 Summary, 576

Therapeutics For Vomiting and Diarrhea, 577

Katrina R. Viviano

Nonspecific Supportive Therapies for Vomiting, 577
 Targeted Therapies With Specific Indications for Vomiting, 581
 Nonspecific Supportive Therapies for Diarrhea, 582
 Targeted Therapies With Specific Indications for Diarrhea, 583
 Summary, 586

Diseases of The Esophagus, 588*Melanie L. Puchot and Susan E. Little*

Introduction, 588

Prevalence, 588

Relevant Physiology and Anatomy, 588

Clinical Presentation, 588

Diagnostic Approach, 589

Specific Diseases, 590

Summary, 599

Diseases of the Stomach, 600*Melanie L. Puchot and Susan E. Little*

Clinical Presentation, 601

Specific Diseases, 601

Summary, 610

Approach to the Cat With Diarrhea, 611*Randolph M. Baral*

Overview, 611

Step 1: Signalment and Clinical History, 612

Step 2: Physical Examination, 613

The Well Cat With Acute Onset Diarrhea, 614

Step 3: Fecal Assessment, 614

Step 4: Blood and Urine Testing, 614

Step 5: Imaging, 616

Step 6: Biopsies, 616

Summary, 616

Diseases of the Intestines, 618*Randolph M. Baral and Andrea M. Harvey*

Inflammatory Bowel Disease, 618

Intestinal Neoplasia, 624

Infectious Enteritis, 634

Intestinal Obstruction, 639

Constipation and Megacolon, 646

Anorectal Diseases, 652

Summary, 654

Gastrointestinal Parasites, 655*Edward Javinsky*

Introduction, 655

Nematodes, 655

Cestodes, 660

Trematodes, 661

Protozoa, 663

Summary, 675

Diseases of the Exocrine Pancreas, 676*Panagiotis G. Xenoulis*

Introduction, 676

Pancreatitis, 676

Exocrine Pancreatic Insufficiency, 688

Pancreatic Cysts, 689

Pancreatic Nodular Hyperplasia, 690

Pancreatic Neoplasia, 690

Summary, 690

Diseases of the Liver, 692*Jonathan A. Lidbury and Debra L. Zoran*

Introduction, 692

Diagnostic Evaluation of the Liver, 692

Diagnostic Approaches, 698

Specific Feline Liver Disorders, 701

Summary, 710

Approach to the Cat With Ascites and Diseases**Affecting the Peritoneal Cavity, 712***Randolph M. Baral and Andrea M. Harvey*

Introduction, 712

Pathophysiology of Ascites, 712

Possible Causes of Ascites, 712

Presentation and Clinical Signs, 712

Diagnostic Approach, 714

Specific causes of Ascites, 718

Summary, 720

27. Endocrinology, 721**Endocrine Pancreatic Disorders, 721***Randolph M. Baral and Susan E. Little*

Overview, 721

Diabetes Mellitus, 721

Neoplasia, 749

Summary, 751

Thyroid Gland Disorders, 752*Randolph M. Baral and Mark E. Peterson*

Hyperthyroidism, 752

Hypothyroidism, 768

Summary, 773

Adrenal Gland Disorders, 774*Mark E. Peterson and Randolph M. Baral*

Hyperadrenocorticism, 774

Catecholamine-Secreting Adrenal Tumors, 783

Hyperaldosteronism, 784

Hypoadrenocorticism, 788

Summary, 792

Pituitary Disorders, 793*Mark E. Peterson and Susan E. Little*

Introduction, 793

Diseases of the Pituitary Gland, 793

Summary, 805

Disorders of Calcium Metabolism, 806*Randolph M. Baral and Natalie C. Finch*

Calcium Homeostasis, 806

Measurement of Calcium, 806

Approach to the Cat With Hypercalcemia, 807

Hypocalcemia, 817

Summary, 821

28. Hematology and Immunology, 822**Hematology and Immune-Related Disorders, 822***Edward Javinsky*

Introduction, 822

Diagnostic Techniques, 822

Erythrocyte Physiology and Diagnostic Evaluation, 827

Clinical Evaluation of Cats With Anemia, 830

Supportive Care for Cats With Anemia, 831

Erythrocyte Disorders, 835

Leukocyte Disorders, 854

Disorders of Hemostasis, 857

Disorders of the Spleen, 863
 Lymphadenopathy, 867
 Systemic Lupus Erythematosus, 868
 Systemic Anaphylaxis, 870
 Summary, 872
Immune Deficiency, Stress, and Infection, 873
Leah A. Cohn
 Immunodeficiency, 873
 Stress and Disease, 874
 Management of the Immunocompromised Cat, 876
 Summary, 877

29. Musculoskeletal Diseases, 878

Greg L.G. Harasen, Susan E. Little, and Georgina Barone
 Introduction: Cats are Not Small Dogs, 878
 Disorders of Bones, 879
 Joint Disease, 884
 Disorders of Muscle, 896
 Conditions of the Front Limb, 899
 Conditions of the Hind Limb, 901
 Neoplasia, 909
 Miscellaneous Musculoskeletal Conditions, 911
 Summary, 916

30. Neurology, 917

Georgina Barone
 Introduction, 917
 Intracranial Diseases, 917
 Peripheral Vestibular Diseases, 932
 Myelopathies, 935
 Neuromuscular Diseases, 944
 Miscellaneous Neurologic Conditions, 949
 Summary, 952

31. Oncology, 953

Jeffrey N. Bryan
Basic Approach to the Feline Cancer Patient, 953
Brooke Fowler
 Introduction, 953
 Diagnosis of Tumor Type, 954
 Cancer Staging, 956
Chemotherapy for the Feline Cancer Patient, 958
Jenna H. Burton
 Introduction, 958
 Chemotherapy Preparation, 958
 Chemotherapy Dosing and Administration, 960
 General Adverse Effects of Chemotherapy, 962
 Commonly Used Chemotherapy Drugs, 964
Selected Feline Cancers, 970
Lymphoma, 970
Kevin Choy and Jeffrey N. Bryan
 Incidence, Etiology, and Risk Factors, 970
 Clinical Features, 970
 Diagnosis and Staging, 971
 Biological Behavior, 972

Treatment and Prognosis, 973
 Supportive Care, 977
 Summary, 978
Injection-Site Sarcoma, 979
William C. Kisseberth
 Incidence, Etiology, and Risk Factors, 979
 Clinical Features, 980
 Diagnosis and Staging, 980
 Biological Behavior, 981
 Treatment, 981
 Summary, 983
Mammary Tumors, 984
Kevin Choy and Jeffrey N. Bryan
 Incidence, Etiology, and Pathogenesis, 984
 Clinical Features, 984
 Diagnosis and Staging, 985
 Treatment, 986
 Prognosis, 987
 Summary, 988
Paraneoplastic Syndromes, 989
Chamisa Herrera
 Introduction, 989
 Dermatologic Manifestations, 989
 Hematologic Alterations, 990
 Endocrinologic Manifestations, 992
 Neuromuscular Manifestations, 992
 Cancer Cachexia and Sarcopenia, 993
 Summary, 993
Palliative Care, 994
Alice E. Villalobos
 Introduction, 994
 Analgesia, 994
 Nutritional Care, 996
 Miscellaneous Care, 998
 Summary, 998

32. Ophthalmology, 999

Christine C. Lim and David J. Maggs
 Introduction, 999
 Ophthalmic Examination and Diagnostic Techniques, 999
 Orbital Disease, 1004
 Eyelid and Adnexal Disease, 1006
 Corneal and Conjunctival Disease, 1009
 Diseases of the Uveal Tract, 1020
 Lens Disease, 1027
 Glaucoma, 1028
 Chorioretinal Disease, 1030
 Summary, 1034

33. Respiratory and Thoracic Medicine, 1035

The Upper Respiratory Tract, 1035
Jessica M. Quimby and Michael R. Lappin
 Introduction, 1035
 Clinical Signs, 1035

General Diagnostics, 1036
 Disease-Specific Recommendations, 1039
 Chronic Rhinosinusitis, 1047
 Neoplasia, 1048
 Spontaneous Disorders, 1048
 Summary, 1048
Diseases of the Larynx, 1049
Samantha Taylor and Andrea M. Harvey
 Signalment, Clinical Signs, and Physical Examination, 1049
 Causes, 1049
 Diagnostic Testing, 1050
 Treatment, 1052
 Summary, 1053

Lower Respiratory Tract Diseases, 1054

Randolph M. Baral and Andrea M. Harvey
 Introduction, 1054
 Clinical Signs, 1054
 Diagnostics, 1054
 Tracheal Disorders, 1059
 Lower Respiratory Tract Diseases, 1060
 Summary, 1080

The Thoracic Cavity, 1081

Randolph M. Baral and Andrea M. Harvey
 Introduction, 1081
 Clinical Signs, 1081
 Physical Examination, 1081
 Pleural Effusion, 1082
 Pneumothorax, 1091
 Diaphragmatic Hernia, 1093
 Chest Wall Pathology, 1095
 Summary, 1095

34. Toxicology, 1096

Tina Wismer

Introduction, 1096
 General Management Principles, 1096
 Management of Selected Toxins, 1100
 Summary, 1122

35. Urinary Tract Disorders, 1124

The Upper Urinary Tract, 1124

Margie Scherk and Jessica M. Quimby
 Introduction, 1124
 Diagnostic Methods, 1124
 Specific Disease Conditions, 1138
 Nonspecific Disease Conditions, 1149
 Summary, 1168

The Lower Urinary Tract, 1169

John M. Kruger and Susan E. Little
 Introduction, 1169
 Diagnostic Methods, 1169
 Specific Lower Urinary Tract Disorders, 1173
 Other Lower Urinary Tract Problems, 1208
 Summary, 1214

36. Concurrent Disease Management, 1215

Hyperthyroidism and Diabetes Mellitus, 1216

Margarethe Hoenig
 Prevalence, 1216
 Patient Signalment and Risk Factors, 1216
 Clinical Signs, 1216
 Pathophysiology, 1216
 Diagnosis, 1217
 Treatment, 1218

Diabetes Mellitus and Obesity, 1219

Margarethe Hoenig
 Introduction, 1219
 Definition of Diabetes Mellitus, 1219
 Definition of Obesity, 1219
 The Link Between Obesity and Diabetes, 1219
 Summary, 1221

Hyperthyroidism and Chronic Kidney Disease, 1222

Sarah Caney
 Introduction, 1222
 Diagnostic Challenges, 1222
 The Link Between Hyperthyroidism and Chronic Kidney Disease, 1223
 Summary, 1224

Chronic Kidney Disease and Degenerative Joint Disease, 1225

Sarah Caney
 Introduction, 1225
 Recognition of Degenerative Joint Disease in Patients With Chronic Kidney Disease, 1225
 Management of Degenerative Joint Disease in Cats With Concurrent Chronic Kidney Disease, 1226
 Conclusions, 1231

Chronic Kidney Disease and Hypertension, 1232

Scott Brown and Rosanne Jepson
 Introduction, 1232
 Prevalence, 1232
 Risk Factors and Pathogenesis, 1232
 Medical History and Clinical Signs, 1233
 Physical Examination Findings, 1233
 Diagnosis of Chronic Kidney Disease and Hypertension, 1234
 Management of Systemic Hypertension in the Patient With Chronic Kidney Disease, 1234
 Management of Chronic Kidney Disease in the Hypertensive Patient, 1236
 Prognosis, 1236
 Owner Education, 1237
 Summary, 1237

Pancreatitis and Inflammatory Bowel Disease, 1238

Debra L. Zoran and Panagiotis G. Xenoulis
 Epidemiology, 1238
 Understanding Why Pancreatitis and Inflammatory Bowel Disease Occur Together, 1238
 Treatment, 1239
 Conclusion, 1242

Pancreatitis and Diabetes Mellitus, 1244*Eric Zini and Marco Pesaresi*

Introduction, 1244

From The Side of Pancreatitis, an Overview, 1244

From The Side of Diabetes Mellitus, an Overview, 1244

Diabetes Mellitus and Pancreatitis, the Histologic Perspective, 1245

Diagnosis of Suspected Pancreatitis Using Standard Diagnostic Tools, 1246

Treating the Diabetic Cat With Acute Pancreatitis, 1248

Glycemic Control and Remission in Diabetic Cats With Concurrent Pancreatitis, 1249

Conclusion, 1250

V

INFECTIOUS DISEASES AND ZONNOSES

37. Fungal Diseases, 1254*Jennifer E. Stokes*

Introduction, 1254

Aspergillosis, 1254

Blastomycosis, 1257

Coccidioidomycosis, 1260

Cryptococcosis, 1262

Histoplasmosis, 1266

Sporotrichosis, 1269

Miscellaneous Fungal Diseases, 1271

Summary, 1272

38. Selected Vector-Borne Diseases, 1273*Jennifer E. Stokes*

Introduction, 1273

Bacteria, 1274

Protozoa, 1278

Summary, 1280

39. Viral Diseases, 1281*Melissa Kennedy and Susan E. Little*

Introduction, 1281

Feline Herpesvirus-1, 1281

Feline Calicivirus, 1284

Feline Panleukopenia, 1287

Feline Coronavirus, 1290

Rabies, 1302

Feline Retroviruses, 1303

Influenza Virus, 1319

Borna Disease Virus, 1320

Papillomavirus, 1320

Cowpox Virus, 1321

Emerging Viruses, 1322

Summary, 1323

40. Bacterial Infections, 1324*Carolyn R. O'Brien*

Introduction, 1324

Streptococcus, 1324*Bartonella*, 1331*Actinomyces*, 1334

Summary, 1342

41. Molecular Assays Used for the Diagnosis of Feline Infectious Diseases, 1344*Michael R. Lappin and Julia Veir*

Introduction, 1344

Molecular Assays, 1344

Current Clinical Applications of Molecular Assays in Feline Medicine, 1345

Summary, 1350

42. Feline Zoonotic Diseases and Prevention of Transmission, 1351*Marcy J. Souza*

Introduction, 1351

Cat Bites, 1351

Bacterial Zoonoses, 1354

Viral Zoonoses, 1356

Parasitic Zoonoses, 1358

Fungal Zoonoses, 1359

Cat Ownership for Immunocompromised People, 1360

Public Health Considerations of Free-Roaming Cats, 1360

Summary, 1361

VI

LIFE STAGE HEALTH CARE

43. Control of Reproduction, 1364*Susan E. Little*

Introduction, 1364

Surgical Sterilization, 1364

Nonsurgical Sterilization, 1365

Contraception, 1366

Pregnancy Termination, 1369

Summary, 1370

44. Male Cats: Normal Reproduction, Reproductive Diseases and Conditions, 1371*Susan E. Little*

Male Anatomy, 1371

Mating Behavior, 1372

Diseases and Conditions of the Penis, 1373

Diseases and Conditions of the Testes, 1374

Disorders of Sex Development, 1376

Infertility, 1377

Summary, 1380

45. Female cats: Normal Reproduction, and Reproductive Diseases and Conditions, 1381

Susan E. Little

- Introduction, 1381
- Anatomy, 1381
- Normal Reproduction, 1381
- Fertility and Breeding Management, 1385
- Clinical Problems, 1386
- Normal Gestation and Parturition, 1389
- Problems With Parturition and the Postpartum Period, 1394
- Infertility, 1402
- Summary, 1416

46. Pediatrics, 1417

Susan E. Little

- Introduction, 1417
- Examination of Young Kittens, 1417
- Kitten Morbidity and Mortality, 1420
- Congenital Defects, 1421
- Diagnostics, 1425
- Basic Therapeutics, 1427
- Management of Common Problems, 1429
- Orphan Kittens, 1435
- Pediatric Spay/Neuter, 1438
- Summary, 1441

47. Managing the Senior Cat, 1442

Susan E. Little and Kelly St. Denis

- Introduction, 1442
- The Impact of Aging, 1443
- Health Care Programs for Senior Cats, 1448
- Nutritional Needs of the Senior Cat, 1451
- Diseases and Health Problems of Senior Cats, 1453
- Special Considerations, 1460
- Summary, 1462

VII

POPULATION MEDICINE

48. Care and Control of Community Cats, 1464

Brenda Griffin

- Introduction, 1464
- Community Cats Defined, 1464
- Controlling Community Cats, 1465
- Special Medical and Surgical Considerations for Community Cats, 1476
- Helping Clients Solve Concerns Related to Community Cats, 1485
- Relocation of Cats, 1485

- Large-Scale Trap-Neuter-Return Programs, 1485
- Liability, 1486
- Summary, 1486

49. Population Wellness: Keeping Cats Physically and Behaviorally Healthy, 1487

Brenda Griffin

- Introduction, 1487
- The Components of Wellness, 1487
- Population Wellness Programs, 1488
- Population Management in Animal Shelters and Capacity for Care, 1490
- Considerations Regarding Infectious Disease Transmission, 1492
- Essential Elements of a Population Wellness Program, 1492
- Developing a Population Wellness Program, 1495
- Summary, 1525

50. A Short Natural History of the Cat and Its Relationship with Humans, 1526

Leslie A. Lyons

- Introduction, 1526
- Domestic Cat Origins, 1526
- Domestic Cat Breeds, 1527
- Origins and Breed Health, 1532
- Summary, 1533

51. The Feline Genome and Clinical Implications, 1534

Leslie A. Lyons

- Introduction, 1534
- Cytogenetics, 1534
- Genetic Maps, 1536
- Feline Genome Sequencing Project, 1538
- Cat DNA Array, 1538
- Whole Genome Sequence and Precision Medicine in Cats, 1539
- The Future of Cat Genetics, 1540
- Conclusion, 1540

52. Genetics of Feline Diseases and Traits, 1541

Leslie A. Lyons

- Introduction, 1541
- Hallmarks of Genetic Diseases, 1543
- Simple Genetic Traits, 1544
- Genetic Risk Factors and Complex Traits, 1553
- Genetic Testing, 1555
- Summary, 1559

Index, 1561

Understanding the Cat and Feline-Friendly Handling

Ilona Rodan

OUTLINE

Introduction, 2
Who is the Cat?, 2
How Cats Perceive the World, 4
How Each Cat is an Individual, 5
Cat Communication, 7
Causes of Distress in Cats, 9

How Cats Respond to Stressors, 10
Feline-Friendly Handling: Preventing Stressors Associated with Veterinary Visits, 14
Hospitalization and Housing Feline Patients, 31
Summary, 36

Cats are not small dogs. (Dr. Barbara Stein)

Cats are not small people. We need to allow cats to be cats! (Dr. Ilona Rodan)

INTRODUCTION

Understanding the cat is the foundation of excellent patient care and feline welfare. Cats are fascinating creatures that are like no other domestic animal.¹ As the most popular pet in many countries and a beloved family member to many, it is essential that we understand the cat, its stressors, and how to best provide for its welfare both at home and in the veterinary practice. With continued advances in feline medicine, many cats now live into their late teens and early twenties, and more than one-fifth of cats seen by veterinarians in the United States are 11 years of age or older.² Awareness of feline stress—or a more appropriate term, distress—and its impact on disease and behavior provides the ability to address distress effectively, improving patient welfare both at home and in the veterinary practice.^{3–6} Medical and behavioral management of serious and chronic conditions enhances feline longevity and the relationships cats share with people. Not only does this improve the lives of cats, but it indirectly enhances the physical and emotional health of the people who own them.^{7–10} Despite the cat's popularity and advancements in feline medicine, at least one-half of companion cats do not visit the veterinary practice on an

annual basis,^{11,12} resulting in unrecognized pain, illness, and distress. Reasons for the lack of veterinary care include the cat appearing healthy and owner's impression of the stress surrounding the veterinary experience.¹² The veterinary visit is not only distressing for cats and owners, but also for veterinary professionals! The goals of feline-friendly handling techniques are to prevent feline distress and the consequent negative emotions (e.g., fear) surrounding the veterinary visit, subsequently reducing human injury.¹³

An understanding of the cat, its stressors, and how we can improve experiences for both owner and cat in the veterinary practice and at home is crucial. This chapter will provide evidence-based information wherever possible to facilitate feline veterinary consultations based on an understanding of the cat—a species so different from dogs and humans.

WHO IS THE CAT?

A Solitary Survivor

An understanding of the cat and its ancestors helps us to better appreciate why the cat may react negatively at the veterinary practice. The earliest known ancestors of the

cat family, *Felidae*, date back 35 million years.¹⁴ Of the 37 species of cats living today, the domestic cat is the only one that is not considered threatened or endangered by conservation organizations. All *Felidae* are hunters and carnivores. Except for the lion, they are solitary hunters that must sustain themselves solely on what they capture. This includes the so-called “domestic cat” surviving on the frequent small prey that they hunt and capture on their own. The cat is essentially a solitary survivor.

The adage of “a cat is not a small dog” holds true from the time of domestication of dogs and cats. The dog descended from the grey wolf 13,000 to 17,000 years ago, a time when humans were hunter-gatherers, and dogs first assisted with hunting, guarding, and other utilitarian activities. The domestic cat, whose scientific name is *Felis silvestris catus*, descended from the North African wildcat, *Felis silvestris libyca* (Fig. 1.1) in the Fertile Crescent about 10,000 years ago with the development of small settlements and the ability to store grains.¹⁵ Grain storage attracted the house mouse, which subsequently attracted cats that were more tolerant of people, leading to a mutualistic relationship between cats and people that required no change to the cat’s normal behavior.¹⁶ Thus cats retain many aspects of their wild predecessors.

Whereas the grey wolf is a very social animal, *Felis silvestris libyca*, still existing today, is not social with other species or even with their own except during mating and the rearing of young kittens. To quote behaviorist John Bradshaw:

The domestic cat has had to transform itself from a solitary, territorial species that regards all humans as enemies, to a (somewhat) gregarious species that can learn to form amicable relationships with people (and other cats). All of this in less time than it took for wolves to become dogs.¹⁷

There are those who think that the domestication of the cat is not yet complete, and that *Felis silvestris catus* is



Fig. 1.1 *Felis silvestris libyca*, also known as the African wildcat, is the predecessor of the domestic cat and still exists today. Courtesy iStock.com.

just a subspecies of *Felis silvestris libyca*.^{15,18} Genetic analysis has demonstrated that the genotypes of the domestic cat are indistinguishable from that of *Felis silvestris libyca*,¹⁴ and it is known that they can interbreed. *Felis silvestris catus* can continue to survive independently, as seen with feral cats that are not fed by humans.

As solitary survivors, cats have amazing athletic abilities and keen senses to allow them to hunt successfully. They have also developed excellent protective mechanisms, including territoriality and the ability to sense and avoid danger. Their emotions and behavioral responses (e.g., their heightened fear response) function to protect them when threatened (see “How cats respond to stressors: the emotional response”). Like their wild ancestors, they hide illness and pain as a protective mechanism, which adds to the mistaken impression that cats are independent and require little or no care. Recognizing these traits aids in understanding how to work with cats within the veterinary hospital.

The Territorial Cat

As solitary hunters and survivors, safe territory is critical to the cat’s survival and more important than relationships with other cats or anything else!¹⁷ Safe territory protects against predators and other dangers and provides the resources that the cat requires. Territory gives the cat a sense of control, security in familiarity and predictability, enhancing the cat’s ability to cope.¹⁹ Most cat communication, such as marking, is meant to protect territory without physical interactions and potential conflict with another cat. Leaving their territory or having unfamiliar people or events within their territory can be highly threatening to the cat, causing a loss of sense of control. The complexity of the territory is more important than size, and this can be simulated in the practice by providing a safe place (see “A place to hide”). Providing a safe place enhances the cat’s ability to cope in the veterinary practice.

Cats Are Social, But Different

The cat is the youngest of the species to be domesticated and the only one whose social structure is derived from a solitary survivor rather than a pack animal.¹ In fact, the cat is the only domestic animal that is solitary in the wild but with the potential to be social with domestication.^{1,20}

The cat’s social structure is flexible, with free-living (e.g., feral) cats choosing to live in social groups or colonies only if sufficient food resources and territory exist.²¹ The social organization of the colony is based on females, usually related, cooperatively nursing and rearing the young.²¹

Males leave the colony when mature, but females may remain in the colony if sufficient resources are present. Colonies are quite insular, and strangers are

generally not welcome and will be driven away. If a new cat persists in visiting the colony, it may eventually be integrated into the group, but the process often takes several weeks. As cats feel threatened by unfamiliar cats, introduction of a new cat into a household should be done gradually. Also, cats in the veterinary practice should not have exposure to unfamiliar cats.

Within a colony, cats may choose preferred associates or affiliates, which are usually related cats. These cats show affection toward each other through affiliative behavior, described under “Tactile communication.”

Although social, cats are solitary hunters. They catch small prey and may need to eat as many as 20 times each day, with many of their hunting expeditions being unsuccessful. Because cats are solitary hunters, they need to maintain their physical health and avoid fights with other cats whenever possible. Much of feline communication is intended to prevent altercations over food and territory, and thus to avoid the risks of active fighting. Cats also communicate with people and if we recognize their communications, aggression can often be avoided.

HOW CATS PERCEIVE THE WORLD

Perception is everything, and we can improve interactions with the cat if we understand how it perceives the world. On a general level, a cat’s perception is based on its senses, most of which are highly sensitive compared to ours. However, each cat is an individual whose perception is also based on the genetic influence of its parents (also known as temperament), as well as the individual’s socialization, experiences, and memories.²² Cats are also influenced by the response of their owners.²³ This means each feline patient must be assessed individually and treated differently based on its coping ability and how it perceives the world. These topics will be addressed in more detail in the next sections.

Sensory Perception

Smell and Pheromones

Cats have an excellent sense of smell, only slightly less acute than dogs. Consider how offensive certain odors are to us to appreciate how an animal with strong protective mechanisms and a sense of smell far superior to ours must feel when it smells unpleasant and unfamiliar odors at the veterinary practice. These include the scent of people and other animals, including cats. Chemical smells, perfumes, and other scents that we may take for granted can also be offensive and cause fear in this species.

On the other hand, knowing the importance of scent to cats can be used to help feline patients. Educate clients about the importance of familiarity, and to bring their

cat to the practice along with some of its familiar and favored objects (e.g., bedding, treats, or toys) to help increase a sense of control and security. This is important for appointments, as well as when cats must stay at the hospital. If the cat is hospitalized or boarded, owners can be requested to bring the cat’s food as well. Leaving a sweatshirt or similar clothing that contains the owner’s scent can help comfort a cat that is “dropped off” or left at the practice without its owner. To help alleviate distress and conflict with other household cats upon return from the practice, cats should be reintroduced gradually, and scent can be exchanged by wiping an “at-home” cat first with a towel and then the returning cat. Synthetic pheromones can also be helpful.

As in most mammals, the cat’s nasal cavity is also involved in the detection of pheromones, chemical messages used to communicate within the same species.²⁴ This will be covered in more detail later under chemical communication.

Hearing

Cats hear higher frequencies than most mammals, including people and dogs.²⁵ This broad range of frequencies includes ultrasound, allowing them to hear the ultrasonic calls or chattering of rodents. Their movable pinnae help localize sounds and their sound localization acuity is excellent,²⁶ aiding in finding prey and protecting themselves from their predators.

Because of their sensitive hearing, sources of acute distress at the veterinary clinic may include ringing telephones, paging systems, and our voices—even when we think we are talking in a normal tone. The noise from centrifuges, x-ray machines, blood pressure monitors, and other medical equipment can startle feline patients. The sounds of other cats and other animals, especially barking, whining, hissing, or shrieking are also potential sources of distress. Using shushing sounds to quiet or calm the cat should be avoided because they sound like the hiss of a cat, and do not calm the patient. Interestingly, the use of classical music in the surgery room lowers blood pressure as well as heart and respiratory rates, and may lead to lower levels of anesthesia needed.^{27,28}

Vision

Cats see well in dim light and their eyes are very sensitive to movement, both enhancing the cat’s hunting skills and ability to protect itself from predators. Consequently, rapid movements, especially if unanticipated, will likely heighten a cat’s responses and can lead to a more reactive patient. When working with cats, therefore, “Slow is fast and fast is slow.” Cats perceive an unfamiliar person staring or looking at it directly as a threat (see “Visual communication” for more information). Although its