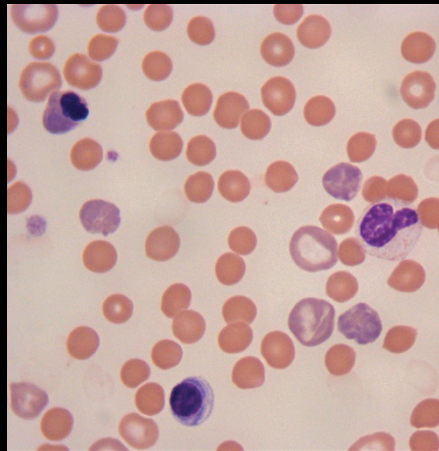
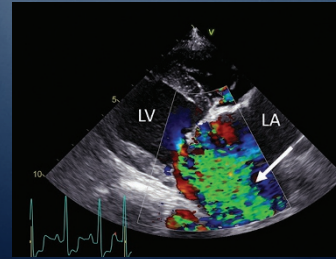


Notes on

FOURTH
EDITION

Canine Internal Medicine

Victoria L. Black · Kathryn F. Murphy
Jessie Rose Payne · Edward J. Hall



WILEY Blackwell

NOTES ON CANINE INTERNAL MEDICINE

NOTES ON CANINE INTERNAL MEDICINE

Fourth Edition

Victoria L. Black,

MA, VetMB, FHEA, DipECVIM-CA, MRCVS

Senior Clinician in Small Animal Medicine

EBVS® European Specialist in Small Animal Internal Medicine

RCVS Specialist in Small Animal Medicine

Langford Vets, Bristol Veterinary School

Bristol, UK

Kathryn F. Murphy,

BVSc, DSAM, PGCertHE, DipECVIM-CA, FRCVS

EBVS® European Specialist in Small Animal Internal Medicine,

RCVS Specialist in Small Animal Medicine

Rowe Referrals, Bristol

VetCT

UK

Jessie Rose Payne,

BVetMed, MVetMed, PhD, DipACVIM (Cardiology), MRCVS

Senior Clinician in Cardiology

ACVIM Specialist in Veterinary Cardiology

RCVS Specialist in Veterinary Cardiology

Langford Vets, Bristol Veterinary School

Bristol, UK

Edward J. Hall,

MA, VetMB, PhD, DipECVIM-CA, FRCVS

Emeritus Professor of Small Animal Internal Medicine

EBVS® European Specialist in Small Animal Internal Medicine

RCVS Specialist in Small Animal Medicine (Gastroenterology)

University of Bristol

Bristol, UK

WILEY Blackwell

This edition first published 2022
© 2022 John Wiley & Sons Ltd

Edition History

Wright Imprint by IOP Publishing Limited
(1e, 1983; 2e, 1986)
Blackwell Science Ltd (3e, 2003)

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by law. Advice on how to obtain permission to reuse material from this title is available at <http://www.wiley.com/go/permissions>.

The right of Victoria L. Black, Kathryn F. Murphy, Jessie Rose Payne and Edward J. Hall to be identified as the authors of this work has been asserted in accordance with law.

Registered Offices

John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA
John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

Editorial Office

9600 Garsington Road, Oxford, OX4 2DQ, UK

For details of our global editorial offices, customer services, and more information about Wiley products visit us at www.wiley.com.

Wiley also publishes its books in a variety of electronic formats and by print-on-demand. Some content that appears in standard print versions of this book may not be available in other formats.

Limit of Liability/Disclaimer of Warranty

The contents of this work are intended to further general scientific research, understanding, and discussion only and are not intended and should not be relied upon as recommending or promoting scientific method, diagnosis, or treatment by physicians for any particular patient. In view of ongoing research, equipment modifications, changes in governmental regulations, and the constant flow of information relating to the use of medicines, equipment, and devices, the reader is urged to review and evaluate the information provided in the package insert or instructions for each medicine, equipment, or device for, among other things, any changes in the instructions or indication of usage and for added warnings and precautions. While the publisher and authors have used their best efforts in preparing this work, they make no representations or warranties with respect to the accuracy or completeness of the contents of this work and

specifically disclaim all warranties, including without limitation any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives, written sales materials or promotional statements for this work. The fact that an organization, website, or product is referred to in this work as a citation and/or potential source of further information does not mean that the publisher and authors endorse the information or services the organization, website, or product may provide or recommendations it may make. This work is sold with the understanding that the publisher is not engaged in rendering professional services. The advice and strategies contained herein may not be suitable for your situation. You should consult with a specialist where appropriate. Further, readers should be aware that websites listed in this work may have changed or disappeared between when this work was written and when it is read. Neither the publisher nor authors shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

Library of Congress Cataloging-in-Publication Data

Names: Hall, E. J. (Ed J.) author. | Black, Victoria L., 1985- author. |

Murphy, K. F. (Kate F.), author. | Payne, Jessie Rose, 1985- author.

Title: Notes on canine internal medicine / Victoria L. Black, Kathryn F.

Murphy, Jessie Rose Payne, Edward J. Hall.

Other titles: Canine internal medicine

Description: Fourth edition. | Hoboken, NJ : Wiley-Blackwell, 2022. |

Hall's name appears first in third edition.

Identifiers: LCCN 2022000939 (print) | LCCN 2022000940 (ebook) | ISBN

9781119744771 (paperback) |

ISBN 9781119744788 (adobe pdf) |

ISBN 9781119744795 (epub)

Subjects: MESH: Dog Diseases | Handbook

Classification: LCC SF991 (print) | LCC SF991 (ebook) | NLM SF 991 | DDC

636.7/0896-dc23/eng/20220209

LC record available at <https://lccn.loc.gov/2022000939>

LC ebook record available at <https://lccn.loc.gov/2022000940>

Cover Design: Wiley

Cover Images: Courtesy of Edward J. Hall, Jessie Rose Payne, Kathryn F. Murphy, and Victoria L. Black

Set in 9/11.5pt Sabon by Straive, Pondicherry, India

10 9 8 7 6 5 4 3 2 1

We all recognise the patience and support of our respective families during the production of this book. However, individually we wish to dedicate it specifically to:

All the vets and vet students I have met with a curious approach to our patients – your enthusiasm continues to inspire and motivate.

Victoria L. Black

Those who inspired me to know more as a student and resident (particularly Ed!) and my colleagues, clients and patients who continue to encourage me to learn more.

Kathryn F. Murphy

My patients, who make each day different from the last and continue to inspire me to learn every day.

Jessie Rose Payne

All the Medicine Residents and colleagues (particularly Kate and Vicki!) I have worked with, who have pushed me to learn more.

Edward J. Hall

CONTENTS

<i>Preface</i>	xvii
<i>Acknowledgements</i>	xix
<i>Using this book</i>	xxi
<i>Commonly used abbreviations</i>	xxiii
Section 1	
Presenting Complaints	1
1.1 Abortion	3
1.2 Alopecia	4
1.3 Altered behaviour	7
1.4 Altered consciousness	10
1.5 Anorexia/hyporexia/inappetence	12
1.6 Anosmia	14
1.7 Anuria/oliguria	15
1.8 Ataxia	17
1.9 Bleeding	19
1.10 Blindness	21
1.11 Constipation	23
1.12 Corneal opacity	25
1.13 Coughing	26
1.14 Deafness	29
1.15 Diarrhoea	30
1.15.1 Acute diarrhoea	31
1.15.2 Chronic diarrhoea	34
1.16 Drooling	38
1.17 Dysphagia	39
1.18 Dyspnoea/tachypnoea	41
1.19 Dysuria	44
1.20 Dystocia	46
1.21 Epistaxis	48
1.22 Exercise intolerance	49
1.23 Faecal incontinence	51
1.24 Flatulence/borborygmi	52
1.25 Haematemesis	54
1.26 Haematochezia	55
1.27 Haematuria and discoloured urine	57
1.28 Haemoptysis	60
1.29 Halitosis	61
1.30 Head tilt	62
1.31 Melaena	64
1.32 Nasal discharge	66
1.33 Nystagmus	67
1.34 Paresis/paralysis	69
1.35 Perinatal death	70

1.36 Polyphagia	72
1.37 Polyuria/polydipsia (PU/PD)	73
1.38 Preputial discharge	77
1.39 Pruritus	78
1.40 Red eye (and pink eye)	80
1.41 Regurgitation	81
1.42 Seizures	84
1.43 Sneezing	86
1.44 Stiffness, joint swelling and generalised lameness	87
1.45 Stunting	89
1.46 Tenesmus and dyschezia	91
1.47 Tremors	92
1.48 Urinary incontinence	94
1.49 Vomiting	96
1.50 Vulval discharge	98
1.51 Weakness, collapse and syncope	100
1.52 Weight gain/obesity	104
1.53 Weight loss	105
Section 2	
Physical Abnormalities	109
2.1 Abdominal enlargement	111
2.2 Abdominal masses	113
2.3 Abnormal lung sounds	115
2.4 Arrhythmias	118
2.5 Ascites	121
2.6 Cyanosis	124
2.7 Eye lesions	126
2.8 Hepatomegaly	129
2.9 Horner's syndrome	131
2.10 Hypertension	133
2.11 Hypotension	134
2.12 Hypothermia	135
2.13 Icterus/jaundice	136
2.14 Lymphadenopathy	139
2.15 Murmur	140
2.16 Oral masses	141
2.17 Pain	142
2.17.1 Abdominal pain	142
2.17.2 Generalised pain	146
2.18 Pallor	147
2.19 Perineal lesions	148
2.20 Peripheral oedema	149
2.21 Pleural effusion	151
2.22 Pneumothorax	154
2.23 Prostatomegaly	154
2.24 Pulse abnormalities	156
2.25 Pyrexia and hyperthermia	158
2.26 Skin lesions	160

2.27	Skin pigmentation changes	167
2.28	Splenomegaly	169
2.29	Stomatitis	171
2.30	Stridor and stertor	172
Section 3		
Laboratory Abnormalities		175
3A	Biochemical tests	177
3.1	Acid–base	177
3.2	Ammonia	178
3.3	Amylase and lipase	179
3.4	Azotaemia	180
3.5	Bile acids	181
3.6	Bilirubin	182
3.7	Calcium	182
	3.7.1 Hypercalcaemia	182
	3.7.2 Hypocalcaemia	183
3.8	Cardiac biomarkers	184
	3.8.1 N-terminal pro B-type natriuretic peptide (NT-proBNP)	184
	3.8.2 Troponin I	185
3.9	Chloride	186
	3.9.1 Hyperchloraemia	186
	3.9.2 Hypochloraemia	186
3.10	Cobalamin	187
3.11	Cortisol (basal)	188
3.12	Creatine kinase	189
3.13	Creatinine	189
3.14	C-reactive protein (CRP)	190
3.15	Folate	191
3.16	Fructosamine	191
3.17	Glucose	192
	3.17.1 Hyperglycaemia	192
	3.17.2 Hypoglycaemia	193
3.18	Iron profile	194
3.19	Lipids	195
	3.19.1 Hyperlipidaemia and hypercholesterolaemia	195
	3.19.2 Hypocholesterolaemia	196
3.20	Liver enzymes	196
	3.20.1 Hepatocellular marker enzymes	196
	3.20.1A Alanine aminotransferase (ALT)	197
	3.20.1B Aspartate aminotransferase (AST)	197
	3.20.1C Other hepatocellular enzymes	197
	3.20.2 Cholestatic marker enzymes	197
	3.20.2A Alkaline phosphatase (ALP or ALKP)	198
	3.20.2B Gamma-glutamyl transferase (GGT)	198
3.21	Pancreatic lipase (cPL)	198
3.22	Phosphate	199
	3.22.1 Hyperphosphataemia	199
	3.22.2 Hypophosphataemia	200

3.23	Potassium	200
3.23.1	Hyperkalaemia	200
3.23.2	Hypokalaemia	201
3.24	Sodium	202
3.24.1	Hypernatraemia	202
3.24.2	Hyponatraemia	202
3.25	Symmetric dimethylarginine (SDMA)	203
3.26	Thyroid hormone	204
3.27	Total protein (albumin and globulin)	206
3.27.1	Hyperproteinaemia	206
3.27.1A	Hyperalbuminaemia	206
3.27.1B	Hyperglobulinaemia	206
3.27.2	Hypoproteinaemia	207
3.27.2A	Hypoalbuminaemia	207
3.27.2B	Hypoglobulinaemia	207
3.28	Trypsin-like immunoreactivity (TLI)	208
3.29	Urea	208
3B	Haematology	210
3.30	Red blood cells (RBCs)	210
3.30.1	Anaemia	210
3.30.2	Erythrocytosis	213
3.31	Platelets	214
3.31.1	Thrombocytopenia	214
3.31.2	Thrombocytosis	215
3.32	White blood cells (WBCs)	216
3.32.1	Leukocytosis	216
3.32.2	Leukopenia	217
3.33	Pancytopenia	218
3C	Urinalysis	219
3.34	Biochemical analysis	219
3.34.1	Protein	219
3.34.2	Bilirubin	219
3.34.3	Glucose	219
3.34.4	Haem	220
3.34.5	Ketones	220
3.35	Sediment	220
3.35.1	Red blood cells	220
3.35.2	White blood cells	220
3.35.3	Epithelial cells	221
3.35.4	Crystals	221
3.35.5	Tubular casts	221
3.35.6	Waxy cast	221
3.36	Urine protein: creatinine (UPC) ratio	221
3.37	Urine specific gravity (USG)	222
Section 4		
Imaging Patterns		223
4.1	Abdomen	225
4.1.1	Radiography	225

4.1.1A	Abdominal enlargement and mass(es)	225
4.1.1B	Calcification (bone/mineral density)	225
4.1.1C	Extra-intestinal gas	228
4.1.1D	Gas dilation of GI tract	229
4.1.1E	Loss of contrast/peritoneal detail/serosal detail	230
4.1.1F	Metal densities	230
4.1.1G	Organ displacement	231
4.1.1H	Organomegaly or change in shape	231
4.1.2	Ultrasound	232
4.1.2A	Free abdominal fluid	232
4.1.2B	Lymphadenopathy – mesenteric/inguinal/sublumbar	232
4.2	Bone	234
4.2.1	Bone deformities	234
4.2.2	Bone density changes	234
4.2.2A	Decreased bone density (osteopenia)	234
4.2.2B	Increased bone density	235
4.2.3	Bone lucencies and proliferative lesions	236
4.3	Thorax	239
4.3.1	Alveolar pattern	239
4.3.2	Bronchial pattern	239
4.3.3	Changes in cardiac outline and pulmonary vasculature	240
4.3.4	Interstitial pattern	244
4.3.5	Loss of detail	245
Section 5		
Organ Systems		247
5.1	Alimentary system	249
5.1.1	Oropharynx	252
5.1.1A	Cranio-mandibular osteopathy	252
5.1.1B	Cricopharyngeal achalasia	253
5.1.1C	Masticatory myositis	253
5.1.1D	Oral neoplasia	254
5.1.1E	Stomatitis	255
5.1.2	Salivary glands	255
5.1.2A	Hypersialosis/salivary gland infarction/sialoadenitis	256
5.1.3	Oesophagus	256
5.1.3A	Foreign body	257
5.1.3B	Megaoesophagus (MO)	258
5.1.3C	Oesophagitis	261
5.1.3D	Sliding hiatal hernia	262
5.1.3E	Stricture	263
5.1.4	Stomach	264
5.1.4A	Acute gastritis	265
5.1.4B	Chronic gastritis	267
5.1.4C	Gastric carcinoma	268
5.1.4D	Gastric dilatation-volvulus (GDV)	269
5.1.4E	Delayed gastric emptying	270
5.1.4F	Gastric ulcer	272

5.1.5	Small intestine	273
5.1.5.1	Acute small intestinal diseases	274
5.1.5.1A	Acute enteritis	275
5.1.5.1B	Acute haemorrhagic diarrhoea syndrome (AHDS)/ haemorrhagic gastroenteritis (HGE)	276
5.1.5.1C	Bacterial enteritis	277
5.1.5.1D	Parvovirus	278
5.1.5.1E	Small intestinal obstruction	280
5.1.5.2	Chronic small intestinal diseases	281
5.1.5.2A	Alimentary lymphoma (AL)	282
5.1.5.2B	Antibiotic-responsive diarrhoea (ARD)	283
5.1.5.2C	Chronic inflammatory enteropathy (CIE)	285
5.1.5.2D	Dietary sensitivity	287
5.1.5.2E	Intestinal parasitism	288
5.1.5.2F	Intestinal protozoal infections	291
5.1.5.2G	Lymphangiectasia	292
5.1.6	Large intestine	293
5.1.6A	Acute colitis	294
5.1.6B	Chronic colitis	295
5.1.6C	Constipation	297
5.1.6D	Granulomatous (histiocytic ulcerative) colitis	298
5.1.6E	Large intestinal neoplasia	298
5.1.7	Pancreas	299
5.1.7A	Acute pancreatitis	300
5.1.7B	Chronic pancreatitis	302
5.1.7C	Exocrine pancreatic insufficiency (EPI)	303
5.2	Cardiovascular system	305
5.2.1	Acquired cardiac diseases	310
5.2.1A	Arrhythmogenic right ventricular cardiomyopathy (ARVC)	310
5.2.1B	Dilated cardiomyopathy (DCM)	311
5.2.1C	Heartworm disease/dirofilariasis	314
5.2.1D	Myxomatous mitral valve disease	316
5.2.2	Congenital cardiac diseases	318
5.2.2A	Aortic stenosis	318
5.2.2B	Mitral valve dysplasia	319
5.2.2C	Patent ductus arteriosus	321
5.2.2D	Pulmonic stenosis	322
5.2.2E	Tetralogy of fallot	324
5.2.2F	Tricuspid dysplasia	325
5.2.2G	Ventricular septal defect	326
5.2.3	Congestive heart failure (CHF)	328
5.2.3A	Left-sided congestive heart failure	330
5.2.3B	Right-sided congestive heart failure	331
5.2.4	Arrhythmias	332
5.2.4.1	Bradyarrhythmias	333
5.2.4.1A	Atrial standstill	333
5.2.4.1B	Atrioventricular (AV) block	333
5.2.4.1C	Sinus bradycardia	336
5.2.4.1D	Sinus arrest	336
5.2.4.1E	Sick sinus syndrome	336

5.2.4.2	Tachyarrhythmias	337
5.2.4.2A	Sinus tachycardia	337
5.2.4.2B	Supraventricular tachyarrhythmias	338
5.2.4.2C	Ventricular tachyarrhythmias	340
5.2.5	Pericardial diseases	343
5.2.5.A	Pericardial effusion	343
5.2.5.B	Peritoneal pericardial diaphragmatic hernia (PPDH)	346
5.3	Endocrine system	347
5.3.1	Diabetes insipidus (DI)	347
5.3.2	Diabetes mellitus (DM)	350
5.3.3	Growth hormone disorders	354
5.3.3A	Acromegaly (hypersomatotropism)	354
5.3.3B	Pituitary dwarfism	355
5.3.4	Adrenal gland disorders	356
5.3.4A	Hyperadrenocorticism (HAC)	356
5.3.4B	Hypoadrenocorticism (Addison's disease)	360
5.3.5	Hypothyroidism	364
5.3.6	Insulinoma	367
5.3.7	Parathyroid diseases	368
5.3.7A	Primary hyperparathyroidism (PHPT)	368
5.3.7B	Hypoparathyroidism	369
5.4	Haemopoietic system	371
5.4.1	Anaemia of chronic kidney disease (CKD)	371
5.4.2	Immune-mediated haemolytic anaemia (IMHA)	373
5.4.3	Iron-deficiency anaemia	377
5.4.4	Lymphoid leukaemia	378
5.4.5	Other haemopoietic neoplasms	379
5.4.6	Leukopenia	380
5.4.7	Thrombosis	380
5.5	Haemostatic system	383
5.5.1	Anticoagulant rodenticide poisoning	386
5.5.2	Disseminated intravascular coagulation (DIC)	388
5.5.3	Factor VIII deficiency (haemophilia A)	390
5.5.4	Hyperfibrinolysis	391
5.5.5	Immune-mediated thrombocytopenia (IMTP)	392
5.5.6	von Willebrand disease	393
5.5.7	Vasculitis	395
5.6	Hepatobiliary system	397
5.6.1	Chronic hepatitis (CH)/cirrhosis	399
5.6.2	Cholangitis/cholangiohepatitis	400
5.6.3	Cholecystitis	401
5.6.4	Congenital porto-systemic shunt (PSS)	402
5.6.5	Copper-associated chronic hepatitis	404
5.6.6	Extra-hepatic bile duct obstruction (EHBDO)	404
5.6.7	Gall bladder mucocoele	405
5.6.8	Hepatic neoplasia	407
5.6.9	Infectious canine hepatitis	408
5.6.10	Nodular hyperplasia	408
5.6.11	Portal vein hypoplasia (PVH)	409

5.6.11A	Microvascular dysplasia (MVD)	409
5.6.11B	Non-cirrhotic portal hypertension/juvenile hepatic fibrosis	410
5.6.12	Steroid hepatopathy	410
5.6.13	Vacuolar/reactive hepatopathy	411
5.7	Immune system	413
5.7.1	(Auto)immune-mediated disorders	414
5.7.1.1	Immune-mediated polyarthritis (IMPA)	414
5.7.1.2	Immunodeficiency	415
5.7.1.2A	Canine leukocyte adhesion deficiency (CLAD)	416
5.7.1.2B	Cyclic haematopoiesis (cyclic neutropenia)	416
5.7.1.2C	Hereditary selective cobalamin malabsorption (Imerslund-Gräsbeck syndrome)	417
5.7.1.2D	Immunoglobulin deficiency	417
5.7.1.2E	Trapped neutrophil syndrome	418
5.7.1.3	Lymphadenitis	418
5.7.1.4	Systemic lupus erythematosus (SLE)	420
5.7.2	Neoplasia of immune cells	420
5.7.2.1	Lymphoma	420
5.7.2.2	Mast cell tumour (MCT)	422
5.7.2.3	Multiple myeloma	424
5.7.2.4	Thymoma	424
5.8	Neurological system	427
5.8.1	Cerebrovascular disease	429
5.8.2	Corticosteroid-responsive tremor syndrome	430
5.8.3	Hydrocephalus	431
5.8.4	Idiopathic epilepsy	431
5.8.5	Idiopathic head tremor	433
5.8.6	Idiopathic vestibular disease	434
5.8.7	Infectious diseases affecting the nervous system	435
5.8.8	Movement disorders	436
5.8.9	Meningoencephalitis of unknown origin (MUO)	437
5.8.10	Myasthenia gravis (MG)	438
5.8.11	Neoplasia of the neurological system	439
5.8.12	Polyradiculoneuritis	441
5.8.13	Steroid-responsive meningitis-arteritis (SRMA)	442
5.9	Reproductive system	445
5.9.1	Mammary gland disease	445
5.9.1A	Mastitis	446
5.9.1B	Mammary neoplasia	446
5.9.2	Ovarian remnant syndrome	447
5.9.3	Prostatic disease	448
5.9.4	Pseudocyesis (false pregnancy)	449
5.9.5	Pyometra	450
5.9.6	Testicular neoplasia	451
5.9.7	Vaginitis	452
5.10	Respiratory system	455
5.10.1	Nasal disorders	457
5.10.1A	Chronic idiopathic rhinitis	457
5.10.1B	Sinonasal aspergillosis (fungal rhinitis)	458
5.10.2	Upper-airway disorders	459
5.10.2A	Brachycephalic obstructive airway syndrome (BOAS)	459
5.10.2B	Infectious tracheobronchitis	460

5.10.2C	Laryngeal paralysis	461
5.10.2D	Tracheal collapse	462
5.10.2E	Tracheobronchial foreign body	464
5.10.3	Lower-airway disorders	464
5.10.3A	Chronic bronchitis	465
5.10.3B	Eosinophilic bronchopneumopathy	465
5.10.3C	Lungworm (<i>Angiostrongylus vasorum</i>)	466
5.10.4	Pulmonary parenchymal disease	468
5.10.4A	Pneumonia	468
5.10.4B	Non-cardiogenic pulmonary oedema	469
5.10.4C	Pulmonary fibrosis	470
5.10.4D	Pulmonary neoplasia	471
5.10.5	Pleural space disease	473
5.10.5A	Idiopathic chylothorax	473
5.10.5B	Pneumothorax	474
5.10.5C	Pyothorax	475
5.11	Systemic infections	477
5.11.1	Anaplasmosis	479
5.11.2	Babesiosis	480
5.11.3	Borreliosis (Lyme Disease)	481
5.11.4	Brucellosis	482
5.11.5	Distemper	484
5.11.6	Ehrlichiosis	485
5.11.7	Hepatozoonosis	486
5.11.8	Leishmaniosis	487
5.11.9	Leptospirosis	489
5.11.10	Neosporosis	491
5.11.11	Rabies	492
5.11.12	Toxoplasmosis	493
5.12	Urinary system	495
5.12.1	Kidney diseases	495
5.12.1A	Acute kidney injury	497
5.12.1B	Chronic kidney disease	499
5.12.1C	Glomerular disorders	501
5.12.1D	Pyelonephritis	503
5.12.1E	Renal tubular disorders	504
5.12.2	Lower urinary tract diseases	506
5.12.2A	Functional disorders of urination	507
5.12.2B	Neoplasia of the urinary system	508
5.12.2C	Urethritis	509
5.12.2D	Urinary tract infection (UTI)	510
5.12.2E	Urolithiasis	511
	<i>Abbreviations</i>	513
	<i>Index</i>	519

PREFACE

“When you hear hoofbeats, look for horses — not zebras.”*

In 1983, in the first edition of *Notes on Canine Internal Medicine*, Peter Darke provided a revolutionary new and simplified diagnostic approach to internal medicine problem solving. It was not long before his book was to be found in the pocket of every veterinary undergraduate in the UK, as well as being an important first source of information for practitioners. The second and third editions built on this success. However, it is now nearly 20 years since the third and last edition and, in that time, our knowledge of canine internal medicine and our ability to investigate and treat cases has grown almost exponentially. Standard internal medicine texts now often fill two large volumes, detailing the underlying pathophysiology that is essential to understand diseases fully. However, there remains a need for a concise text to aid students and busy practitioners.

Whilst we acknowledge the importance of pathophysiology in internal medicine, in first opinion practice knowing the three most likely differential diagnoses for a problem is of more use than knowing ten obscure and unlikely ones despite potentially similar pathophysiological mechanisms. Thus, in this book, we have provided separate lists of the ‘common causes’ of medical problems, and the ‘uncommon causes’. Our personal experiences and geographical location inevitably bias our opinions on what are the most common causes of any specific problem but please note that these two lists are in alphabetical order and not order of prevalence. We are also not indicating the relative incidence of specific problems seen in first opinion practice, although practitioners will already know that dermatological and GI problems are most common. Our opinions on what are the best approaches to a specific problem are based on the scientific evidence, where it is available, and on our personal experience.

This edition follows a similar pattern to the third edition, with sections on presenting complaints, physical findings, and laboratory abnormalities. We have added a new section on imaging patterns, and again finish with a section covering diseases of the major organ systems. The authorship has been expanded to ensure we have the expertise to cover all areas of internal medicine, including Peter Darke’s own discipline of cardiology. We have also included information on behavioural, dermatological and ophthalmological problems focused on where these are manifestations of systemic disease. We do not believe in a totally algorithmic approach as used in some texts and have highlighted key clinical clues which, when using the results of history-taking, physical examination, laboratory tests and imaging findings, should guide the clinician’s investigation in the right direction and avoid unnecessary testing.

As noted in the first edition, the recognition that not everything in internal medicine is black and white is part of its challenge; and not every patient ‘reads the textbook’. We still believe in the advice of the first edition that *‘basic, careful history-taking and thorough and, if necessary, repeated clinical examination are fundamental procedures that may yield a diagnosis in a complicated or unresolved case’*. One should always remember that there is always one more question to be asked, or one more investigation to be performed on problem cases, and one should never be afraid to go back to the beginning and start again.

V.L.B, K.F.M., J.R.P. and E.J.H.
2022

* Source uncertain; <https://quoteinvestigator.com/2017/11/26/zebras/>

ACKNOWLEDGEMENTS

The initial inspiration for this book was Peter Darke's and we are honoured to write this new edition. The book retains its original title to emphasise its aim to be easily accessible notes for the veterinary practitioner and student to assist their diagnostic investigations of medically ill dogs.

USING THIS BOOK

SECTION 1

Presenting complaints

- In this section, the common presenting complaints are listed alphabetically according to a stylised format.
- Each problem is defined, and the expected clinical signs listed although not every case will show every sign.
- Causes for the problem are divided into ‘common’ and ‘uncommon’ to guide the reader, but are only the opinion of the authors, and may vary in different geographical locations.
- For each problem a logical diagnostic approach is suggested; any numbering indicates a suggested order for the investigations:
 - Clinical clues in the history.
 - Potential findings in the clinical examination.
 - Laboratory findings that aid the diagnosis.
 - Key results from imaging.
 - Special tests that may confirm the diagnosis.

SECTION 2

Physical problems

In this section, significant findings from the physical examination are listed alphabetically.

- Each problem is defined.
- Common and uncommon causes, listed alphabetically, are suggested for each problem.
- Related clinical signs are listed.
- For each problem a logical diagnostic approach is suggested.
- Key findings to look for in the history and physical examination are noted; not all will be present in every case.
- Laboratory findings that aid the diagnosis are noted.
- Key results of imaging are noted.
- Special tests that may confirm the diagnosis are listed.

SECTION 3

Laboratory abnormalities

In this section laboratory abnormalities of haematology, serum biochemistry and urinalysis are listed alphabetically.

- The abnormality is defined.
- Causes are listed alphabetically, and the likely degree of severity is suggested.
- The diagnostic interpretation for the abnormality is given.
- Adjunctive tests that may help support or confirm the diagnosis are given.

SECTION 4

Imaging patterns

Differential diagnoses for specific plain radiographic and ultrasonographic patterns and appearances are listed. Relevant further imaging modalities (contrast radiography, cross-sectional imaging, i.e. CT and MRI) are suggested.

SECTION 5

Organ systems

The relevant clinical presentations and physical, laboratory and imaging abnormalities (identified in Sections 1–4, respectively) are given for each major internal organ system. Then the diagnostic approach and the methods of investigation of each organ system are briefly explained. Finally, the more common diseases of each system are covered alphabetically. For each, its aetiology, predisposition, historical clues, clinical signs, laboratory test results, treatment and monitoring, sequelae and prognosis are given in note form.

COMMONLY USED ABBREVIATIONS

Commonly used scientific and medical abbreviations listed here are used throughout the book without further expansion. All other abbreviations are spelled out in each section, and are listed at the end of the book with the Index.

ACTH	adrenocorticotrophic hormone
ALP (SAP)	(serum) alkaline phosphatase
ALT	alanine aminotransferase
BID	twice daily (q12h)
CBC	complete blood count
ECG	electrocardiogram
EDTA	ethylenediaminetetra-acetic acid
ELISA	enzyme-linked immunosorbent assay
HCT	haematocrit
IgA	immunoglobulin A
IM	intramuscular
IV	intravenous
NPO	<i>nil per os</i> (nothing by mouth)
NSAID	non-steroidal anti-inflammatory drug
PCR	polymerase chain reaction
PCV	packed cell volume
PO	<i>per os</i>
QID	four times daily (q6h)
<i>q.v.</i>	<i>quod vide</i> (see related material)
RBC	red blood cell
SC	subcutaneous
SID	once daily (q24h)
T4	thyroxine
TID	three times daily (q8h)
WBC	white blood cell

SECTION 1

PRESENTING COMPLAINTS

In this section, the common presenting complaints are listed alphabetically according to a stylised format.

- Each problem is defined, and the expected clinical signs listed, although not every case will show every sign.
- Causes for the problem are divided into ‘common’ and ‘uncommon’ to guide the reader, but are only the opinion of the authors, and may vary in different geographical locations.
- For each problem a logical diagnostic approach is suggested; any numbering indicates a suggested order for the investigations:
 - Clinical clues in the history.
 - Potential findings in the clinical examination.
 - Laboratory findings that aid the diagnosis.
 - Key results from imaging.
 - Special tests that may confirm the diagnosis

1.1	Abortion	3	1.21	Epistaxis	48
1.2	Alopecia	4	1.22	Exercise intolerance	49
1.3	Altered behaviour	7	1.23	Faecal incontinence	51
1.4	Altered consciousness	10	1.24	Flatulence/borborygmi	52
1.5	Anorexia/hyporexia/inappetence	12	1.25	Haematemesis	54
1.6	Anosmia	14	1.26	Haematochezia	55
1.7	Anuria/oliguria	15	1.27	Haematuria and discoloured urine	57
1.8	Ataxia	17	1.28	Haemoptysis	60
1.9	Bleeding	19	1.29	Halitosis	61
1.10	Blindness	21	1.30	Head tilt	62
1.11	Constipation	23	1.31	Melaena	64
1.12	Corneal opacity	25	1.32	Nasal discharge	66
1.13	Coughing	26	1.33	Nystagmus	67
1.14	Deafness	29	1.34	Paresis/paralysis	69
1.15	Diarrhoea	30	1.35	Perinatal death	70
	1.15.1 Acute diarrhoea	31	1.36	Polyphagia	72
	1.15.2 Chronic diarrhoea	34	1.37	Polyuria/polydipsia (PU/PD)	73
1.16	Drooling	38	1.38	Preputial discharge	77
1.17	Dysphagia	39	1.39	Pruritus	78
1.18	Dyspnoea/tachypnoea	41	1.40	Red eye (and pink eye)	80
1.19	Dysuria	44	1.41	Regurgitation	81
1.20	Dystocia	46			

1.42 Seizures	84	1.48 Urinary incontinence	94
1.43 Sneezing	86	1.49 Vomiting	96
1.44 Stiffness, joint swelling and generalised lameness	87	1.50 Vulval discharge	98
1.45 Stunting	89	1.51 Weakness, collapse and syncope	100
1.46 Tenesmus and dyschezia	91	1.52 Weight gain/obesity	104
1.47 Tremors	92	1.53 Weight loss	105

1.1 ABORTION

DEFINITION

The spontaneous expulsion of one or more fetuses before the end of full-term pregnancy, i.e. when the fetus is incapable of independent life.

RELATED CLINICAL SIGNS

- Abdominal pain
- Abnormal vulval discharge
- Fever
- Lethargy/depression
- Premature whelping is reported with live or dead pups or no live pups at term

COMMON CAUSES

Infectious

- Bacterial
 - *Brucella canis* in endemic countries; not endemic in UK
 - *Streptococcus* infection
- Viral: Canine herpesvirus-1 (CHV-1)

Non-infectious

- Congenital defects: various lethal defects
- Genetic causes: various lethal defects
- Maternal factors:
 - Illness
 - Diabetes mellitus (DM)
 - Eclampsia
 - Pregnancy toxemia
 - Drugs
 - Corticosteroids
 - Griseofulvin
 - Itraconazole
 - Phenylephrine
 - Prolactin inhibitors
 - Prostaglandins
 - Progesterone-receptor blockers
 - Toxins: insecticides, plant toxins

- Trauma
- Hypoluteinization (low progesterone)
- Advanced age
- Traumatic: dystocia

UNCOMMON CAUSES

Infectious

- Bacterial
 - *Escherichia coli*
 - *Campylobacter*
 - *Leptospira*
 - *Salmonella*
- Fungal
- Protozoal
 - *Leishmania*
 - *Neospora*
 - *Toxoplasma*
- Viral
 - Bluetongue virus
 - Canine adenovirus 1
 - Canine distemper virus
 - Canine parvovirus 1 (minute virus)

DIAGNOSTIC APPROACH

Clinical clues

Predisposition

- Advanced age
- Previous history of abortion
 - Assess for hypoluteinization by checking progesterone concentrations

History

- Abnormal vulval discharge
- Bitch whelps early with live or dead pups or no pups at term

Clinical examination

Visual inspection

- Often unremarkable

Physical examination

- Abdominal contractions and expulsion of fetus(es) in later pregnancy
- Vulval discharge: purulent, haemorrhagic, green, black, malodorous

Laboratory findings

Haematology

- May be normal
- HCT often low in pregnancy due to decreased plasma volume, e.g. 30–35% compared to 45–55%
- Mild mature neutrophilia common in pregnancy, may sometimes be more pronounced changes or bands

Serum biochemistry

- May be normal

Urinalysis

- May show evidence of inflammation with free catch or catheter samples

Imaging

Plain radiographs

- May show evidence of dystocia

Ultrasound

- May show evidence of fetal death

Special tests

- Examination of fetus post mortem
- Virus isolation/bacterial culture/PCR of fetus/placenta/vaginal secretions/milk

Tests of dam

- Serology \pm PCR of dam for CHV-1, *B. canis*
- Serum progesterone to assess if sufficient to maintain pregnancy: should be > 2 ng/ml (6 nmol/l); if less than these values for > 48 hours suggests hypoluteinization but can be seen due to fetal death
- Thyroid hormone analysis: total T4/thyroid-stimulating hormone (TSH)

1.2 ALOPECIA

DEFINITION

Absence of hair from areas of skin that normally carry hairs, due either to a failure of production or to an increased loss of hair. Hypotrichosis refers to thinning of hair. Hair loss may be focal or diffuse, and symmetrical or non-symmetrical.

RELATED CLINICAL SIGNS

- Endocrinopathies are likely to cause concurrent systemic signs such as changes in drinking, eating, exercise tolerance and body weight
- Loss or absence of hair
- Self-traumatic lesions if pruritic skin disease

COMMON CAUSES

Primary follicular disease

Inherited abnormalities of follicular structure, ranging from absence of follicles that normally

produce hair of a particular colour to complete absence of follicles, are uncommon except in specific breeds.

Secondary follicular disease

- Bacterial folliculitis/superficial pyoderma
- Demodectic mange
- Hyperadrenocorticism (HAC)
 - Iatrogenic
 - Pituitary- or adrenal-dependent
- Hypothyroidism
- Interdigital pyoderma
- *Malassezia* infection
- Seasonal flank alopecia (cyclic follicular dysplasia)

Self-trauma when pruritic

- Atopy
- Fleas and flea-allergic dermatitis
- Pyotraumatic dermatitis ('hot spot')
- Sarcoptic mange
- Secondary bacterial pyoderma