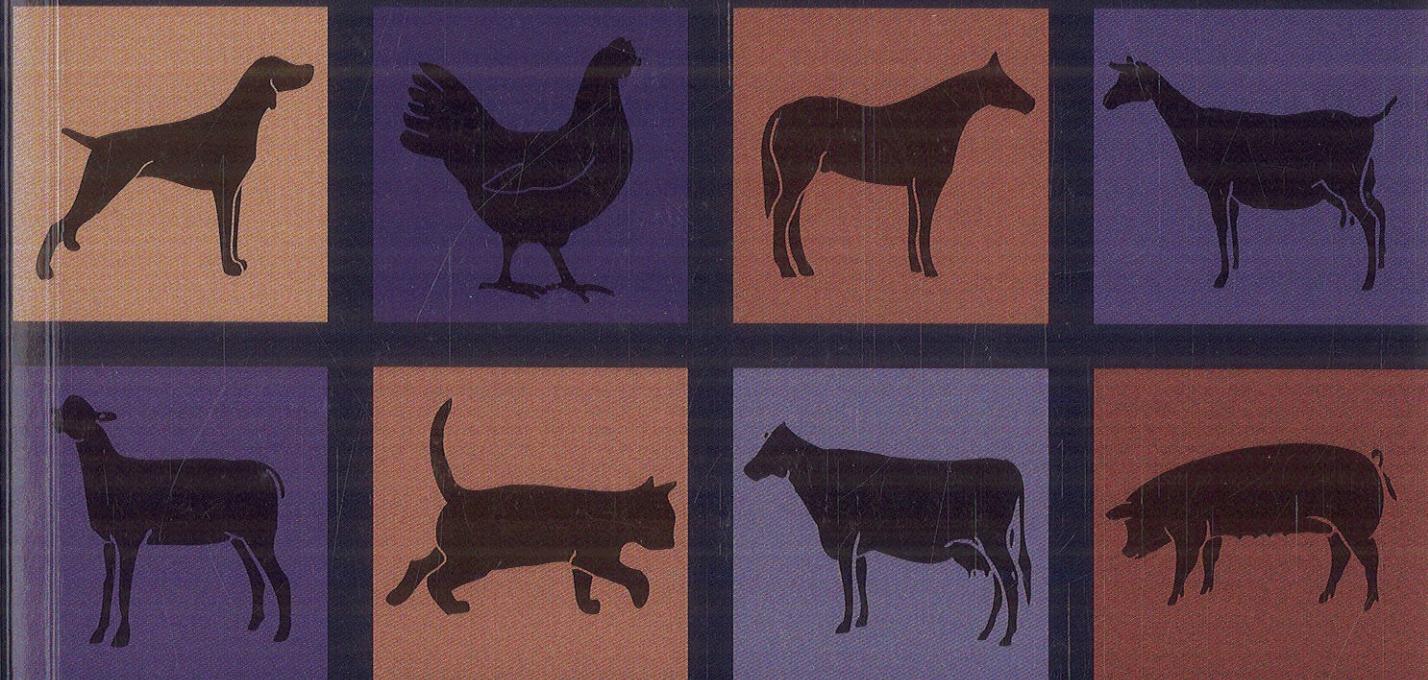


# Functional Anatomy and Physiology of Domestic Animals

FOURTH EDITION

William O. Reece



WILEY-BLACKWELL

# Contents



Preface .....	xi
Acknowledgments .....	xiii
<b>1 Basics of Structure and Function .....</b>	<b>3</b>
The Cell, Its Structure and Functions .....	3
Energy Production .....	6
Functions of DNA and RNA .....	7
Embryology .....	11
Tissues .....	13
Directional Terms and Planes .....	19
Body Cavities .....	21
<b>2 Body Water: Properties and Functions .....</b>	<b>28</b>
Physicochemical Properties of Solutions .....	28
Distribution of Body Water .....	36
Water Balance .....	37
Dehydration, Thirst, and Water Intake .....	39
Adaptation to Water Lack .....	41
<b>3 Blood and Its Functions .....</b>	<b>45</b>
General Characteristics .....	45
Leukocytes .....	47
Erythrocytes .....	55
Fate of Erythrocytes .....	60
Iron Metabolism .....	61
Anemia and Polycythemia .....	63
Hemostasis: Prevention of Blood Loss .....	64
Prevention of Blood Coagulation .....	71
Tests for Blood Coagulation .....	73
Plasma and Its Composition .....	74
<b>4 Nervous System .....</b>	<b>84</b>
Structure of the Nervous System .....	84
Organization of the Nervous System .....	87
The Nerve Impulse and Its Transmission .....	104
Reflexes .....	111
The Meninges and Cerebrospinal Fluid .....	114
Central Nervous System Metabolism .....	119
<b>5 The Sensory Organs .....</b>	<b>124</b>
Classification of Sensory Receptors .....	124
Sensory Receptor Responses .....	125

Pain . . . . .	125
Taste . . . . .	127
Smell . . . . .	130
Hearing and Equilibrium . . . . .	132
Vision. . . . .	140
<b>6 Endocrine System . . . . .</b>	<b>160</b>
Hormones . . . . .	160
Pituitary Gland . . . . .	161
Thyroid Gland. . . . .	165
Parathyroid Glands. . . . .	168
Adrenal Glands. . . . .	169
Pancreatic Gland . . . . .	174
Prostaglandins and Their Functions . . . . .	175
<b>7 Bones, Joints, and Synovial Fluid. . . . .</b>	<b>179</b>
General Features of the Skeleton. . . . .	179
Bone Structure . . . . .	187
Bone Formation . . . . .	193
Bone Repair . . . . .	196
Joints and Synovial Fluid. . . . .	198
<b>8 Muscle . . . . .</b>	<b>206</b>
Classification. . . . .	206
Arrangement . . . . .	208
Skeletal-Muscle Harnessing . . . . .	209
Microstructure of Skeletal Muscle . . . . .	210
Skeletal-Muscle Contraction . . . . .	216
Comparison of Contraction among Muscle Types. . . . .	222
Changes in Muscle Size . . . . .	223
<b>9 The Cardiovascular System. . . . .</b>	<b>228</b>
Heart and Pericardium. . . . .	228
Blood Vessels . . . . .	234
Lymphatic System. . . . .	237
Spleen . . . . .	242
Cardiac Contractility. . . . .	245
Electrocardiogram . . . . .	247
Heart Sounds . . . . .	251
Heart Rate and Its Control . . . . .	251
Blood Pressure . . . . .	254
Blood Flow . . . . .	256
Capillary Dynamics. . . . .	260
<b>10 The Respiratory System. . . . .</b>	<b>269</b>
Respiratory Apparatus. . . . .	270
Factors Associated with Breathing . . . . .	275

Respiratory Pressures . . . . .	282
Pulmonary Ventilation . . . . .	283
Diffusion of Respiratory Gases . . . . .	286
Oxygen Transport . . . . .	287
Carbon Dioxide Transport . . . . .	290
Regulation of Ventilation . . . . .	292
Respiratory Clearance . . . . .	296
Nonrespiratory Functions of the Respiratory System . . . . .	298
Descriptive Terms and Pathologic Conditions . . . . .	300
Avian Respiration . . . . .	301
<b>11 The Urinary System . . . . .</b>	<b>312</b>
Gross Anatomy of the Kidneys and Urinary Bladder . . . . .	312
The Nephron . . . . .	317
Formation of Urine . . . . .	323
Glomerular Filtration . . . . .	324
Tubular Reabsorption and Secretion . . . . .	327
Countercurrent Mechanism . . . . .	329
Concentration of Urine . . . . .	333
Extracellular Fluid Volume Regulation . . . . .	336
Aldosterone . . . . .	337
Other Hormones with Kidney Association . . . . .	338
Micturition . . . . .	339
Characteristics of Mammalian Urine . . . . .	340
Renal Clearance . . . . .	341
Maintenance of Acid-Base Balance . . . . .	344
Avian Urinary System . . . . .	347
<b>12 Digestion and Absorption . . . . .</b>	<b>359</b>
Introductory Considerations . . . . .	360
The Oral Cavity and Pharynx . . . . .	361
The Simple Stomach . . . . .	365
Intestines . . . . .	367
Accessory Organs . . . . .	376
Composition of Foodstuffs . . . . .	379
Pregastric Mechanical Functions . . . . .	384
Gastrointestinal Motility . . . . .	385
Mechanical Functions of the Stomach and Small Intestine . . . . .	388
Mechanical Functions of the Large Intestine . . . . .	391
Digestive Secretions . . . . .	392
Digestion and Absorption . . . . .	398
The Ruminant Stomach . . . . .	400
Characteristics of Ruminant Digestion . . . . .	404
Chemistry and Microbiology of the Rumen . . . . .	407
Ruminant Metabolism . . . . .	408
Avian Digestion . . . . .	411

<b>13</b>	Body Heat and Temperature Regulation . . . . .	421
	Body Temperature . . . . .	421
	Physiologic Responses to Heat . . . . .	422
	Physiologic Responses to Cold . . . . .	426
	Hibernation . . . . .	427
	Hypothermia and Hyperthermia . . . . .	428
<b>14</b>	Male Reproduction . . . . .	432
	Testes and Associated Structures . . . . .	432
	Descent of the Testes . . . . .	437
	Accessory Sex Glands and Semen . . . . .	438
	Penis and Prepuce . . . . .	440
	Muscles of Male Genitalia . . . . .	442
	Blood and Nerve Supply . . . . .	444
	Spermatogenesis . . . . .	445
	Erection . . . . .	450
	Mounting and Intromission . . . . .	451
	Emission and Ejaculation . . . . .	451
	Factors Affecting Testicular Function . . . . .	451
	Reproduction in the Avian Male . . . . .	452
<b>15</b>	Female Reproduction . . . . .	458
	Functional Anatomy of the Female Reproductive System . . . . .	458
	Hormones of Female Reproduction . . . . .	468
	Ovarian Follicle Activity . . . . .	471
	Sexual Receptivity . . . . .	476
	Estrous Cycle and Related Factors . . . . .	477
	Pregnancy . . . . .	482
	Parturition . . . . .	487
	Involution of the Uterus . . . . .	492
	Reproduction in the Avian Female . . . . .	493
<b>16</b>	Lactation . . . . .	501
	Functional Anatomy of Female Mammary Glands . . . . .	501
	Mammogenesis . . . . .	506
	Lactogenesis and Lactation . . . . .	507
	Composition of Milk . . . . .	510
	Milk Removal and Other Considerations . . . . .	512
	Appendix A. Normal Blood Values . . . . .	517
	Index . . . . .	524