



Table of Contents

1	Animal Function and Ecological State	1
1.1	Introduction	1
1.2	Animal habits and their impact on the Ecosystem	2
1.3	Animal functioning and its impact on the ecosystem	3
1.4	Types of Ecological Relationship with Organisms	6
1.4.1	Commensalism: Zero or Positive Interaction	6
1.4.2	Competition: The Double Negative Interactions	6
1.4.3	Amensalism: A negative / Zero Interaction	7
1.4.4	Predation: One Wins and One Loses	7
1.4.5	Mutualism: Everyone Wins	8
1.5	Conclusion	8
1.6	References	9
2	Building Blocks of Animal Physiology	10
2.1	Introduction	10
2.2	Structure of Molecules and Cells in Animal Physiology	11

2.2.1	Types of Molecules: Animal Physiology	12
2.2.2	Framework and Types of cells: Animal Physiology	14
2.3	Cell Function	16
2.3.1	Regulation of Cell Function by Enzymes	17
2.3.2	Competitive and Noncompetitive Inhibition	18
2.3.3	Allosteric Inhibition and Activation	19
2.3.4	Cofactors and Co-enzymes	19
2.3.5	Enzyme Compartmentalization	20
2.4	Feedback Inhibition in Metabolic Pathways	21
2.4.1	Conclusion	22
2.5	Reference	22
3	Genomics and Proteomics	23
3.1	Introduction	23
3.2	Genomic Approach	25
3.3	Proteomics Approach	28
3.4	Metabolomics	30
3.5	Conclusion	30
3.6	References	31
4	Epigenetics and its Role in Animal Physiology	32
4.1	Introduction	32
4.2	Physiological Development	33
4.2.1	Apoptosis	33
4.2.2	Growth and Development	34
4.2.3	Neonatal	35
4.2.4	Infancy	35
4.2.5	Adolescence	36
4.2.6	Adulthood	37
4.2.7	Old Age	38
4.3	Epigenetics	39
4.3.1	Molecular Basis	40
4.3.2	DNA Damage	40
4.3.3	Techniques Used for studying Epigenetics	41
4.3.4	Development	41
4.3.5	Transgenerational	42
4.4	References	44
5	Transportation of Water and Solutes	45
5.1	Introduction	45

5.2	Passive Transportation of Solute by Simple Diffusion	48
5.2.1	Simple Diffusion	50
5.2.2	Facilitated Diffusion	51
5.2.3	Channels	52
5.2.4	Carrier Proteins	53
5.3	Filtration and Osmosis	55
5.4	Electrochemical Gradient	56
5.4.1	The Chemical Context of Chemistry	58
5.4.2	The Biological Context	58
5.5	Reference	59
6	Digestion in Animals	60
6.1	Introduction	60
6.2	Animal Physiology and Use of Nutrients	61
6.3	Sources of Nutrients	62
6.3.1	Water	62
6.3.2	Fats	62
6.3.3	Minerals	63
6.3.4	Vitamins	63
6.4	Feed Additives	64
6.5	Animal Digestive System	64
6.6	Feeding	65
6.7	Absorption	68
6.8	References	68
7	Metabolism in Animals	69
7.1	Introduction	69
7.1.1	Substrate-level “Phosphorylation”	71
7.1.2	Aerobic Phosphorylation and Respiratory Chain.	71
7.2	Basic Terms of the energy metabolism	71
7.3	Importance of Energy Metabolism	72
7.3.1	Bioenergetics and Chemical Reactions	73
7.3.2	Cellular Metabolism	73
7.4	Different types of Energy	73
7.4.1	Kinetic Energy	74
7.4.2	Potential Energy	74
7.4.3	Chemical Energy	74
7.5	Metabolism of Carbohydrates	75
7.6	Energy Production from Carbohydrates (Cellular Respiration)	75
7.7	Role of organs in the process of “energy metabolism”	76

7.7.1	Other Organs	77
7.8	References	78
8	Aerobic and Anaerobic Metabolism	79
8.1	Introduction	79
8.2	Definitions	80
8.3	Aerobic form of Metabolism: Animals	81
8.3.1	Types of Aerobic Metabolism in Animal Physiology	81
8.4	Anaerobic form of Metabolism: Animals	83
8.4.1	Types of Anaerobic Metabolism in Animal Physiology	83
8.5	Relationship between Aerobic and Anaerobic forms of metabolism: Animals	85
8.5.1	The Similarities Between Aerobic and Anaerobic Forms of Metabolism	86
8.5.2	The dissimilarities Between Aerobic and Anaerobic Forms of Metabolism	86
8.6	Conclusion	88
8.7	Reference	89
9	The Energetics of Aerobic Activity	90
9.1	Introduction	90
9.2	Study of Energetics of Active Animals	91
9.2.1	Study of Movements: Animals Who Can Walk	92
9.2.2	Study of Movements: Animals Who Can Fly	92
9.2.3	Study of Movements: Animals Who Can Swim	92
9.3	Energy Cost of Explicit Exercise/ Activities	93
9.3.1	Explicit Energy Cost of Exercise: Animals Which Can Swim	93
9.3.2	Explicit Energy Cost of Exercise: Animals Which Can Run or Walk	93
9.3.3	Explicit Energy Cost of Exercise: Animals Which Can Fly	94
9.4	Maximum Rate of Oxygen Intake	94
9.4.1	Principles of Maximum Rate of Oxygen Intake	95
9.4.2	Variance in the Aerobic Capacity	95
9.5	Energetics: Regular Life and Active Life	96
9.5.1	Comparison	96
9.6	Energetics: Ecology	97

9.7	Conclusion	98
9.8	Reference	99
10	How Animals Survive in Frigid Weather Conditions	100
10.1	Introduction	100
10.2	Food, Nutrition, Energy metabolism and Thermoregulation in the lives of the Mammals	101
10.3	Metabolism	105
10.4	Thermo-regulatory Development: Small mammals compared with large	106
10.5	The Effect of Body Size on Mammals' Lives in Cold Environments	107
10.6	Hibernation as a winter strategy: New directions and discoveries	108
10.7	References	109
11	Neurons	110
11.1	Introduction	110
11.2	Nervous System	112
11.2.1	Description of the Nervous System	113
11.2.2	Diagnosing Nervous system Conditions	113
11.2.3	Disease of the Nervous System	114
11.3	Anatomy and Histology	114
11.3.1	Membrane	115
11.3.2	Histology and Internal Structure	115
11.4	Neurotransmitters	117
11.4.1	Types of Neurons	117
11.4.2	Neurons of the Central Nervous System	118
11.4.3	Peripheral Nervous system	119
11.5	Reference	120
12	Role of Synapse in Animal Physiology	121
12.1	Introduction	121
12.2	Chemical Synapse	122
12.3	Electrical Synapse	125
12.3.1	Effects of Electrical Synapses	126
12.4	Synaptic plasticity	128
12.4.1	Long – term Potentiation (LTP)	128
12.4.2	Long – term Depression (LTD)	129
12.5	References	129

13 Sensory Systems	130
13.1 Introduction	130
13.2 Organisation of Sensory Systems	131
13.3 Taxonomy of Sensory Receptor Cells	132
13.4 Sensory Information	133
13.5 Mechanoreception	134
13.6 Vestibular Organs	134
13.7 Chemoreception	135
13.8 Olfaction	136
13.9 Photoreception	136
13.10 References	139
14 Nervous System and Biological Clocks	140
14.1 Introduction	140
14.2 Constituents of Nervous System	142
14.3 Principles of functional organization.	144
14.3.1 Functions of Brain are Localized.	144
14.3.2 There are maps in Brains.	145
14.3.3 Size of the Brain Matters.	147
14.3.4 Recurrent Enlargement of the Forebrain Parts is Involved in the Evolution of the Brain in Vertebrates.	147
14.3.5 Neural Connections are Flexible.	147
14.4 Biological Clock.	148
14.4.1 Animals Possess Endogenous Rhythms.	150
14.5 References.	151
15 Endocrine and Neuroendocrine System in Animals	152
15.1 Introduction	152
15.2 Endocrine Principles	153
15.2.1 Hypothalamic-Pituitary Relationships	154
15.2.2 Anterior Pituitary Controls	155
15.2.3 Posterior Pituitary Function	156
15.3 Synthesis, Storage, and Release of Hormones	157
15.4 Types of Endocrine Cells and Glands	160
15.4.1 Hypothalamus	161
15.4.2 Pituitary Gland	161
15.4.3 Thyroid Gland	162
15.4.4 Adrenal Glands	163
15.4.5 Pineal Body	163
15.4.6 Reproductive Glands	163

15.5 Reference	163
16 Reproduction	164
16.1 Introduction	164
16.1.1 Importance of Reproduction	165
16.2 Types of animal reproduction	165
16.2.1 Asexual Reproduction in Animals	165
16.2.2 Sexual Reproduction in Animals	167
16.3 Reproduction in Humans	169
16.3.1 Male Reproductive System	170
16.3.2 Process of the Sperm Production and Maturation	171
16.3.3 Structure of Female Reproductive System	172
16.3.4 Oogenesis	174
16.3.5 Menstruation	175
16.3.6 Pregnancy	177
16.4 References	178
17 Navigation in Animal Physiology	179
17.1 Introduction	179
17.2 Significance of Animal Navigation	180
17.2.1 Reproductive Success is Promoted by Honed Navigational Skills.	180
17.2.2 Food Acquisition is Facilitated by Enhanced Navigational Skills.	181
17.2.3 Navigational Abilities are Required for Migration.	182
17.3 Navigational Strategies.	182
17.3.1 Following a trail or remembering the Landmarks	183
17.3.2 Orientation by Polarized Light	183
17.3.3 Orientation by sun and Night Sky	184
17.3.4 Magnetoreception	185
17.3.5 Olfactory Navigation	185
17.3.6 Gravity Receptors	186
17.3.7 Way Marking	186
17.3.8 Other Senses	186
17.4 Path Integration	186
17.5 Animal Navigation being affected by Human Activities.	189
17.6 References.	189

18 Muscle	190
18.1 Introduction	190
18.2 Types of muscles	192
18.2.1 Skeletal Muscle (Striated or Striped Muscle)	192
18.2.2 Non- striated Muscles (Smooth Muscles)	194
18.2.3 Cardiac Muscles	195
18.3 Structure of Muscle	197
18.4 Microanatomy and Gross Anatomy of a muscle	198
18.5 Contraction of Muscles	199
18.6 Nervous Control	200
18.7 Summary	200
18.8 References	201
19 Muscles and Movement in Animal Physiolog	202
19.1 Introduction	202
19.2 Muscle Phenotype	204
19.3 Atrophy	206
19.3.1 Disuse of Atrophies	207
19.3.2 Muscle Atrophy	208
19.4 Regulating Muscle Mass	209
19.5 References	210
20 Role of Carbon Dioxide and Oxygen in Animal Physiology	211
20.1 Introduction	211
20.2 Chemical Potential	213
20.3 Diffusion of Gases	215
20.4 Convective transport of Gases: Bulk Flow	216
20.5 Transport of gas by altering convection and diffusion	216
20.6 Physical properties of Water and Air	217
20.7 Respiratory Environment	218
20.8 References	220
21 Respiration in Animals	221
21.1 Introduction	221
21.2 Respiration within Aquatic Animals	223
21.2.1 Fish Physiology	223
21.2.2 The Respiratory System within Gastropods	224
21.2.3 Anthropods	225
21.2.4 Aquatic Reptiles, Birds, and Amphibians	227

21.3	Regulation of Respiration	227
21.4	Respiration Procedure in Mammals	228
21.5	References	231
22	Circulatory System in Animals	232
22.1	Introduction	232
22.2	Heart	233
22.2.1	Myogenic Hearts	235
22.2.2	Neurogenic Hearts	237
22.3	Dissipation of Energy	239
22.4	References	240
23	Oxygen, Carbon Dioxide and Internal Transport at Work: Diving Marine Mammals	241
23.1	Diving	241
23.2	Diving Feats and Behaviour	242
23.3	Types of Dive and the Importance of Method	243
23.4	Physiology: An Introduction.	243
23.5	The Oxygen Stores of Divers	244
23.5.1	The Blood Oxygen Store Tends to be Large in Diving Mammals	244
23.5.2	Diving Mammals Have High Myoglobin Concentrations and Large Myoglobin Bound	245
23.5.3	Diving Mammals Vary in their use of the lungs as an Oxygen store	245
23.5.4	Total Oxygen stores never permit dives of Maximum Duration to be fully Aerobic.	245
23.6	Circulatory Adjustments during Dives	246
23.7	Metabolism during Dives	247
23.8	The Aerobic Dive Limit: An Important Way to Understand Diving Behaviour	249
23.9	Decompression Sickness	250
23.10A	Possible Advantage for Pulmonary Oxygen sequestration in deep dives	251
23.11	References	252
24	Excretion in Animals	253
24.1	Introduction	253
24.2	Types of excretory system	254
24.3	The urinary system	255
24.3.1	Kidney	255

24.3.2	Ureters	261
24.3.3	Bladder	261
24.3.4	Urethra	261
24.4	Pulmonary excretion	262
24.5	Biliary excretion	262
24.6	Substances of the excretory system	262
24.7	Nitrogen excretion	263
24.8	Disorders of the excretory system.	264
24.9	References	264
25	Mammals Surviving in Arid Climatic Conditions	265
25.1	Introduction	265
25.2	Environment in the dry – Savannas and the Deserts	266
25.3	Relation between Water and Animal	267
25.4	Water conflict challenges Humans and Animals	269
25.5	The dramatic adaptation process of some specific species	270
25.6	Reference	271
	Index	272