

CONTENTS

PREFACE	xiii	Class – Mammalia	184
Chapter 1		Type study of the Class	
CHORDATE CLASSIFICATION AND TYPE STUDY		Mammalia – <i>Rattus</i>	196
Classification of Phylum chordata	2	A modern scheme of Classification of	
Subphylum – Urochordata/Tunicata	3	Mammals	227
Type study of the Subphylum			
Urochordata – <i>Ascidia</i>	7	Chapter 2	
Subphylum – Cephalochordata/		COMPARATIVE ANATOMY OF CHORDATES	
Acrania	11	Integument and integumentary	
Type study of the Subphylum		derivatives in vertebrates	233
Cephalochordata – <i>Branchiostoma</i>	12	General structure of skin	233
Subphylum – Vertebrata/Craniata	21	Integument of fishes	235
Superclass – Agnatha	22	Integument of amphibians	238
Class – Cephalaspidomorphi	22	Integument of reptiles	238
Order – Cyclostomata	22	Integument of birds	239
Type study of the Order		Exoskeleton of birds	240
Cyclostomata – <i>Petromyzon</i>	23	Integument of mammals	243
Superclass – Gnathostomata	36	Horns in mammals	244
Class – Chondrichthyes	36	Antlers in mammals	244
Type study of the Class Chon-		Digestive system in chordates	246
drichthyes – <i>Scoliodon</i>	37	Digestive system of <i>Branchiostoma</i>	247
Class – Osteichthyes	58	Digestive system in <i>Ascidia</i>	250
Type study of the Class		Stomach in <i>Columba</i>	252
Osteichthyes – <i>Channa</i>	65	Ruminant stomach	252
Class – Amphibia	77	Dentition in vertebrates	254
Type study of the Class		Respiratory system in vertebrates	259
Amphibia – Toad	80	Respiratory system of <i>Scoliodon</i>	259
Class – Reptilia	113	Respiratory system of <i>Lates</i>	260
Type study of the Class		Accessory respiratory organs	261
Reptilia – <i>Calotes</i>	119	Swim bladder	265
Class – Aves	140	Weberian ossicles	274
Type study of the Class		Lungs in birds	274
Aves – <i>Columba</i>	146	Lungs in mammals	274

Circulatory system in vertebrates	275	Codes of Nomenclature	310
Modification of aortic arches in vertebrates	275	Requisites of Nomenclature	311
Modification in fishes	275	The International Code	311
Modification in amphibians	275	Priority	312
Modification in reptiles	276	Principles under which nomenclature operates	312
Modification in birds	277	Kinds of Types	314
Modification in mammals	277	Limitations of priority	314
Portal system in vertebrates	277	Homonyms	314
Comparison of poisonous and non-poisonous snakes	279	Synonyms	315
Venom	280	Tautonyms	315
Poison apparatus and biting mechanism	281	Species concept	316
Excretory system in vertebrates	285	Typological species concept	316
Nervous system in vertebrates	289	Nominalistic species concept	317
		Evolutionary species concept	317
		Biological species concept	318
		Speciation	321
		Rate of the speciation process	321
		Mechanism of speciation	321
		Classification of speciation	322
		Modes of speciation	322
		Allopatric speciation	322
		Parapatric speciation	325
		Sympatric speciation	326
		Quantum speciation	326
		Polyploidy and hybrid speciation	327
		Rates of speciation	328
		Factors affecting speciation rate	328
Chapter 3		Chapter 4	
TAXONOMY		ECOLOGY, TOXICOLOGY, BIODIVERSITY AND WILDLIFE	
Taxonomy, Systematics and Classification	291	Ecology	329
Contribution of systematics to biology	292	Branches of ecology	329
Scope of taxonomy	294	Ecosystem	331
Problems of taxonomists	294	Components of ecosystem	331
α , β and γ taxonomy	294	Various terms used and their definition	332
Microtaxonomy and Macrotaxonomy	295	Kinds of ecosystem	333
History of taxonomy	295	Pond as an ecosystem	333
Terms in taxonomy	296	Forest as an ecosystem	335
Modern trends in taxonomy	300	Energy flow in ecological systems	336
Morphological approach	300	Fundamental concepts related to energy	336
Embryological approach	301	Solar radiation	336
Ecological approach	301		
Behavioural approach	301		
Genetical approach	301		
Biochemical approach	302		
Numerical taxonomy	303		
Differential systematics	304		
Zoological classification	305		
Rules of classification	305		
Identification	305		
Downward and upward classification	306		
Kinds of classification	306		
Functions of classification	307		
Hierarchical classification	307		
Linnaean Hierarchy	308		
Zoological nomenclature and its rules	310		
Origin of Binomial system	310		

Concept of productivity	337	Communities	402
Concept of energy subsidy	337	Types of community	402
Concept of source-sink energetics	337	Community characteristics	402
Energy fixation and estimates of primary productivity	338	Species composition	402
Energy beyond the producers	339	Species dominance	402
Characteristics of energy flow	340	Role of species interactions in community structure	403
Models of energy flow	341	Spatial structure	404
Food chain and food web	343	Community periodicity	405
Concentration of toxic substances along food chain	348	Synusia and guild	406
Ecological pyramids	349	Ecotone and edge effect	406
Ecological factors	351	Habitat and ecological niche	407
Light	351	Niche concept	408
Temperature	353	Resource partitioning	412
Rainfall	356	Ecological succession	413
Biogeochemical cycles	358	Sequence of succession	413
Nitrogen cycle	359	Types of succession	413
Nitrogen cycle and Biotechnology	361	Causes of succession	414
Carbon cycle	362	Examples of succession	416
Global balance of Carbon cycle	366	Climax community	418
Biotic factors	367	Wetland ecosystem	421
Intraspecific association	367	Types of wetland	421
Interspecific association	369	Marine wetland ecosystems	422
Neutralism	370	Mangrove swamps	422
Competition	370	Salt marshes	422
Amensalism	371	Floodland ecosystems	423
Positive/Negative interactions	372	Swamp and marsh ecosystems	424
Allelopathy	373	Bog ecosystems	425
Predation	373	Importance of wetlands	429
Parasitism	379	Environmental degradation	431
Positive interactions	381	Classification of pollutants	431
Commensalism	381	Types of pollution	432
Protocooperation	381	Air pollution	432
Mutualism	382	Water pollution	445
Population	384	Soil/Land pollution	462
Properties of population	384	Noise pollution	469
Population density	384	Environmental toxicology	477
Natality	386	Effects of chemical exposure	477
Mortality	387	Acute toxic effects	478
Population growth	392	Chronic toxic effects	481
Age structure	396	Biomonitoring of environment	482
Patterns of distribution	397	Bioassay and its application	486
Population genetics	399	Environmental impact assessment (EIA)	487
Population regulation	400	Elements of the environmental impact assessment process	488

Design of an environmental impact assessment	489	Aims and objectives of animal behaviour	546
International EIAs	490	Behaviour diversities	549
Case study : Atmospheric component of an EIA for a coal-fired power station	490	Instinctive behaviour or FAP	549
Case study : Land development projects – probable impact categories	492	Sign stimulus or releaser	551
Biodiversity	493	Components of FAP	551
Value of biodiversity	493	Characteristics of Instincts	552
Biodiversity profit of India	495	Conservative nature of FAP	552
Types of biodiversity	500	Learning behaviour	552
Megadiversity zones	503	Learning by animals	553
Hotspots of biodiversity	504	Ability to learn	555
Threats to biodiversity	509	Types of learnt behaviour	556
Conservation of biodiversity	510	Differences between instinctive and learned behaviour	559
Conservation	512	Complex behaviour	560
Aims of conservation	512	Latency	560
Conservation strategies	512	Summation	561
Categories of conservation	514	Warm-up or facilitation or motor-recruitment	561
<i>In-situ</i> conservation	514	Inhibition	562
<i>Ex-situ</i> conservation	514	Feedback control	563
Conservation of soil	514	Chronobiology	566
Conservation of water	516	Circadian rhythm	567
Wildlife	522	Rhythm gene	570
Wildlife conservation and management	522	Communication	571
Wildlife conservation in India	523	Basic components of communication	571
Purpose of wildlife conservation	525	Modes of communication	571
Methods of wildlife conservation	527	Bee dance	574
Biosphere reserve	530	Pheromones	576
Network of protected areas	532	Classification of pheromones	576
National Park	532	Chemical nature of pheromones	577
Sanctuary	534	Pheromones in animals	578
Threatened species	535	Functions of pheromones	585
Project Tiger	537	Adverse effects of pheromones	587
		Ecolocation in bats	588
		Anatomical structure in sound production and reception	588
		Characteristics of echolocation sounds	591
		Effectiveness of acoustic orientation of bats	594
		Working space and information content of echoes	595
		Predator-prey relationship	597
		Sociobiology	599
		Eusocial insects	599
		Eusociality in termites	599
		Social behaviour in honey bee	602

Chapter 5

ANIMAL BEHAVIOUR

Introduction to animal behaviour	541
Historical perception in animal behaviour	541
Approach to Ethology	543
Conceptual – Theoretical – Empirical approaches in Ethology	545

Cooperation	605	Vector biology	663
Range of cooperative behaviours	605	Mosquitoes	664
Paths to the evolution and maintenance of cooperation	606	Biology of common mosquitoes	666
Ecological factors involved in cooperation	609	Genus <i>Culex</i>	666
Coalitions	610	Genus <i>Anopheles</i>	666
Selfishness	610	Genus <i>Aedes</i>	667
Sociobiology and selfish genes	611	Genus <i>Mansonia</i>	667
Selfish behaviour	611	Role of mosquitoes as vector	669
The selfish herd	611	Mosquito control measures	670
Altruism	612	Ticks and Mites	672
Evolving of altruistic behaviour	612	Ticks	673
Reciprocal altruism	614	Mites	677
Kinship	614	Control of ticks and mites	680
Alarm calls and kinship	614	Mite allergy	681
Kinship theory	615	Introduction to immunology	684
Conflict within families	616	Immune system	685
Kin recognition	620	Cells of immune system	685
Parental investment	621	Organs of immune system	690
Forms of parental investment	622	Macrophages	697
Types of sexual selection	622	Immunity and immune responses	701
Parental investment in fishes	623	Innate immunity	701
Sex ratio and parental investment	630	Adaptive immunity	704
Investment by step-parents	630	Collaboration between innate and adaptive immunity	706
Role of males and females in parental investment	631	Immune responses	707
Effects and costs of parental investment	631	T cell and cell-mediated immunity	710
Parent-offspring conflict	632	B cell and humoral immunity	713
		Other forms of adaptive immunity	718
		Antigen and Adjuvant	720
		Antigen	720
		Adjuvant	722
		Immunoglobulin/Antibody	724
		Structure and Classification	724
		Immunoglobulin G	731
		Immunoglobulin A	732
		Immunoglobulin M	733
		Immunoglobulin E	734
		Immunoglobulin D	734
		Antigen-Antibody interaction	735
		T cell receptor	743
		Cytokines	749
		Complement system	755
		Classical pathway	756
		Alternate pathway	760
		Lectin pathway	762
		Functions of complement system	763
		Elementary ideas of vaccination	769
		Vaccines	769

Chapter 6

PARASITOLOGY AND IMMUNOLOGY

Animal symbiosis/Association	635
Phoresis	636
Mutualism	636
Commensalism	638
Parasitism	638
Interrelationship between symbiosis	642
Leishmania	643
<i>Leishmania donovani</i>	644
<i>Leishmania tropica</i>	647
<i>Wuchereria bancrofti</i>	648
Host-Parasite interaction	654

Chapter 7

ENDOCRINOLOGY

Introduction to endocrinology,	
Endocrine glands, Hormones and their mechanism of action	775
General characteristics of hormones	778
General mechanism of hormone action	782
Classification and structure of receptors	783
Membrane receptors	783
Signal transduction	785
Nuclear receptors	793
Classification of hormones	795
Pituitary gland	797
Adenohypophysis	798
Neurohypophysis	800
Hormones of adenohypophysis	801
Pro-opiomelanocortin hormone	
family	801
Corticotropin	801
Melanocyte-stimulating hormone	803
Lipotropins	803
Somatomammotropins	803
Functions of growth hormone	803
Functions of prolactin	804
Glycoprotein hormones	805
Functions of thyrotropin	805
Functions of FSH	806
Functions of LH	806
Hormones of neurohypophysis	807
Functions of vasopressin	807
Functions of oxytocin	807
Disorders in functions of neurohypophyseal hormones	812
Thyroid gland	814
Thyroid hormone	816
Physiological roles of thyroid hormones	819
Calcitonin	820
Pathophysiology	821
Hypothyroidism	821
Hyperthyroidism and Thyrotoxicosis	823
Graves' disease	823
Other disorders of thyroid function	823
Pancreas	826
Hormones of endocrine pancreas	828
Insulin	828
Glucagon	831
Somatostatin	833
Interactions of islet cell hormones	833
Disorders in pancreatic endocrine function	833
Adrenal gland	838
Hormones of adrenal cortex	843
Hormones of adrenal medulla	846
Physiological roles of adrenal hormones	847
Cortical hormones	847
Medullary hormones	849
Disorders of adrenocortical functions	851
Cushing's syndrome	852
Conn's syndrome	853
Other adrenocortical dysfunctions	854
Ovary	856
Ovarian follicles	856
Hormones of ovary	859
Physiological roles of ovarian hormones	861
Disorders in ovarian endocrine function	863
Amenorrhea	864
Polycystic ovarian disease	864
Hirsutism and virilisation	864
Hypothalamic-pituitary-ovarian axis	865
Testis	867
Blood testis barrier	872
Hormones of testis	872
Physiological roles of androgens	874
Disorders in testicular endocrine function	876
Male pseudohermaphroditism	877
Reproductive cycles in mammals	879
Estrous cycle	879
Hormonal regulation of estrous cycle	883
Menstrual cycle	883
Hormonal interaction during menstrual cycle	886
Endocrine glands in insects:	
Secretion and Function	887
Endocrine organs of nervous origin	887

Endocrine organs of epithelial origin	887	Metabolism	977
Neurohormones of the brain	888	Carbohydrate metabolism	977
Hormones of corpora allata	890	Embsden-Meyerhof pathway	977
Hormones of ecdysial gland	890	Krebs Cycle/TCA Cycle	985
Functions of endocrine organs		Respiratory chain (ETC)	989
in insects	890	Oxidative phosphorylation	992
Chapter 8		Cori Cycle	995
PHYSIOLOGY AND BIOCHEMISTRY		Glyconeogenesis	996
Vertebrate blood	897	Lipid metabolism	997
Haemostasis, Clotting and		Oxidation of fatty acids	998
Coagulation	901	Ketosis	1001
ABO blood group	906	Glycerol metabolism	1002
Rhesus system	907	Synthesis of fatty acids	1002
Respiration and respiratory pigments	909	Protein metabolism	1004
Enzymes	914	Transamination	1005
Models of enzyme catalysis	916	Oxidative deamination	1007
Specificity of enzyme	917	Decarboxylation	1008
Factors influencing enzyme activity	917	Nitrogen excretion –	
Michaelis constant	921	the urea cycle	1009
Nerve impulse propagation	923	Vitamins	1013
Synapse	926		
Process of transmission of nerve		Chapter 9	
Impulse through synapse	927	BIOTECHNOLOGY AND MOLECULAR BIOLOGY	
Osmoregulation	929	Genetic engineering	1021
Carbohydrates	934	Basic steps in recombinant	
Monosaccharides	934	DNA technology	1021
Disaccharides	941	Restriction enzymes	1022
Oligosaccharides	943	DNA ligase	1024
Polysaccharides	943	Vectors	1028
Protein	946	Cloning vectors	1028
Amino acids	946	Plasmid vectors	1028
Classification of proteins	952	pBR vector plasmid	1030
Primary structure of protein	955	pUC vector plasmid	1031
Secondary structure of protein	955	Bacteriophage as vectors	1033
Quaternary structure of protein	960	λ vector	1033
Lipids	961	Replacement λ vectors	1035
Simple lipids	961	Insertion λ vectors	1036
Fatty acids	962	Cosmids as vectors	1036
Chemical properties of lipids	964	Phagemids as vectors	1036
Waxes	968	BAC vectors	1037
Soaps and Synthetic detergents	968	PAC vectors	1038
Compound lipids	971	YAC vectors	1039
Steroids	974	Expression vectors	1040
Functions of lipids	975	Some special vectors	1044
		Construction of recombinant DNA	
		molecule and their cloning	1044
		cDNA	1044

Genomic DNA	1048	R-factor	1080
DNA library	1050	Bacteriophage Mu	1080
Genomic DNA library	1050	Transposable elements in	
Chromosome specific library	1050	eukaryotes	1082
cDNA libraries	1051	Transposons in yeast	1082
Screening of genomic		Transposable elements in plants	1083
DNA library	1051	Transposable elements in <i>Drosophila</i>	1085
Screening cDNA library	1053	Copia element	1085
Application of genetic engineering	1055	P element	1085
Application in medicine	1055	Transposable elements in human	1086
Agricultural application	1061	Molecular markers : SNPs, STRs,	
Industrial application	1063	VNTRs, RFLP, RAPD and AFLP	1088
Application in		Single-nucleotide polymorphism	1088
environment management	1066	Short tandem repeats	1090
Polymerase chain reaction	1069	Variable number tandem repeats	1090
Basic polymerase chain reaction	1069	Restriction fragment length	
Inverse PCR	1071	polymorphism	1091
Anchored PCR	1071	Randomly amplified	
DOP-PCR	1072	polymorphic DNA	1092
Differential PCR	1072	Amplified fragment length	
RT-PCR	1072	polymorphism	1094
Advantages of PCR	1072	DNA fingerprinting/DNA typing/	
Disadvantages of PCR	1073	DNA profiling	1096
Application of PCR	1074	Applications	1097
Transposable element in prokaryotes		Gene therapy	1100
and eukaryotes	1076	Germ line gene therapy	1100
Transposable elements		Somatic cell gene therapy	1100
in prokaryotes	1076	Methods of gene therapy	1100
Insertion sequences (IS)	1076	Clinical trials of gene therapy	
Transposon (Tn)	1077	in humans	1102
Transposable elements in plasmids	1079		
F-factor	1079	INDEX	1105