ANATOMY AND PHYSIOLOGY

FARM ANIMALS
FOR STUDENTS OF AGRICULTURE

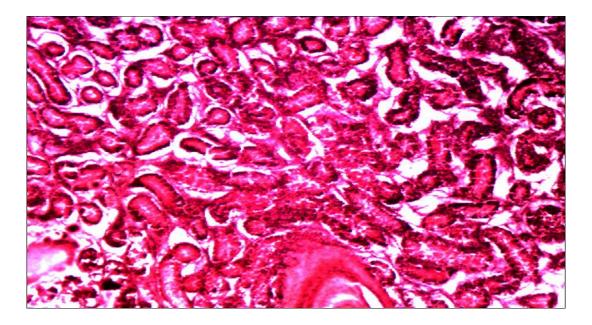


Omotunde Oluseyi Ademuyiwa Fasanya

(DVM, M.Sc., Ph.D. PROFESSOR OF REPRODUCTIVE PHYSIOLOGY)

ANATOMY AND PHYSIOLOGY OF FARM ANIMALS FOR

STUDENTS OF AGRICULTURE



ISBN: 978-978-53763-0-2 2015 FIRST EDITION

OMOTUNDE OLUSEYI ADEMUYIWA FASANYA

(DVM, M.Sc., Ph.D. (PROFESSOR OF REPRODUCTIVE PHYSIOLOGY)

PRODUCTION SUPPORTED BY: TERTIARY EDUCATION TRUST FUND (TETFUND)

PUBLISHED BY THE ACADEMIC PUBLISHING UNIT OF THE FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE, NIGERIA.

COPYRIGHT STATEMENT: THE COPY RIGHT OF THIS PUBLICATION IS THE EXCLUSIVE RIGHT OF THE ACADEMIC PUBLISHING UNIT OF THE FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA. NO PART OF THIS PUBLICATION MAY BE REPRODUCED, STORED IN A RETRIEVAL OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC, PHOTOCOPYING MECHANICAL RECORDING OR OTHERWISE WITHOUT PRIOR PERMISION OF THE PUBLISHER OR A LICENCE PERMITTING RESTRICTED COPYING.

ACKNOWLEDGEMENTS

This manuscript was conceived in 1985 when I started lecturing at the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria. Consequently, I am grateful to Ahmadu Bello University, Zaria and all Staff and Students of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University Zaria.

The contribution of my late wife Mrs. Marie Oluremi Adeoti Fasanya in preparing some of my teaching aids is sincerely appreciated. I wish to acknowledge the deep concern of my children Opeoluwa Olusola Babayemi and Omolabake Oluyinka Ayoola Fasanya during my career progression. I thank Jummai Aisha Fasanya my wife who immediately joined the support the family has gathered to ensure that we are successful with this manuscript. Also, my daughter In-law Dr.(Mrs). Rabi Rebecca Mimi Fasanya who joined the queue to ensure that the family remained graceful during my career progression.

I seize this opportunity to thank those who search for knowledge and when found, it is shared with others. The opportunity afforded me by the Department of Veterinary Physiology and Pharmacology, Faculty of Veterinary Medicine Ahmadu Bello University Zaria where I spent my sabbatical year between 1999 and 2001 is appreciated. The final layout of the manuscript was prepared during the year 2000/2001 while in the department. The production of the manuscript has been made possible by the Academic Publishing Unit of The Federal University of Technology, Minna Niger State Nigeria.

The assistance of some members of staff of the Departments of Veterinary Pathology and Microbiology, Veterinary Anatomy both of the Faculty of Veterinary Medicine Ahmadu Bello University, Zaria in preparing the photographs and slides used in this manuscript is sincerely appreciated.

The assistance of Mr. S.A. George and his son Daniel both of the Deans Office School of Agriculture and Agricultural Technology, Federal University of Technology, Minna about 2007 when the typing of some aspects of this manuscript began is sincerely appreciated.

PREFACE

This is the first edition of this textbook published by Professor O. O. A. Fasanya. Professor Fasanya has been teaching undergraduate and postgraduate students in agriculture and animal health terrain for over 30 years. He stated his teaching career in The Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria before proceeding to The Federal University of Technology, Minna, Niger State, Nigeria. The textbook covers anatomy and physiology of farm animals. The materials therein covers Cell biology, Cell physiology, Microscopic Anatomy, Gross anatomy of skeleton, digestive, nervous, circulatory, reproductive, renal and endocrine systems and detailed Physiology of digestive systems in ruminants. These materials are very handy and adequate for the students of agriculture and veterinary medicine. The textbook has many illustrations, pictures and photomicrographs which has made the textbook easy for comprehension.

All books can be improved and this book being the first edition is no exception. The author welcomes constructive criticism from knowledgeable colleagues and students and will depend upon you the readers to point out items that need to be changed, added or deleted. With your help he looks forward to a greater improved next edition.

DEDICATION

This work is dedicated to Opeoluwa, Olusola, Babayemi and Oluyinka, Omolabake Ayoola Fasanya [God blessed children] and Grandson Luke Philip Akinoluwa, OluwatosinOluseyiFasanya.

TABLE OF CONTENTS

CONTENTS	PAGE
Acknowledgements	ii
Preface	iii
Dedication	iv
Table of content	v-ix
List of Figures	vii
List of Plates	viii
List of tables	ix
Chapter One	1
Cell Biology	1-3
Cytoplasm	4-5
Nucleus	6-7
Plasma membrane	7-9
Endoplasmic reticulum	9-11
Golgi Apparatus	11-16
Mitochondria	16-19
Chapter Two	20
Cell Membrane Physiology	20-21
Active Transport	21-22
Permeability of membranes	22-23
Filtration	23-25
Chapter Three	26
Histological Techniques (Instruments-Microtomes)	26-30
Chapter Four	31
Tissue preparation	31-34
Chapter Five	35
Microscopic Anatomy	35
Classification of Body Tissues	35-38
Connective and Supportive Tissues	38-43
Cartilage	43-46
Chapter Six	47
Classical Cell types of body tissues	47-52

Chapter seven	53
Musculoskeletal system	53
Arrangement of muscle fibres	53-59
Chapter Eight	60
Classification of the skeletal system	60-61
The Bone	61-65
Chapter Nine	66
Anatomy of the Digestive system	66-70
Classification of animals based on stomach	
Complexity	70-77
Chapter Ten	78
Physiology of the Digestive system	78-98
Chapter Eleven	99
Circulatory system	99-105
Chapter Twelve	106
Respiratory System	106-110
Chapter Thirteen	111
Nervous system	111-114
Chapter Fourteen	115
Reproductive system	115-129
Chapter Fifteen	130
Renal System	130-134
Chapter Sixteen	135
Endocrine system	135-144
List of References	145-148

LIST OF FIGURES

FIGU	RES	PAGES
1.1	Typical cell [Animal (a) and Plant (b)] showing the nucleus,	
	Cytoplasm and cell membrane.	1
1.2.	Sketch of the rough endoplasmic reticulum	11
1.3	Sketch of golgi apparatus showing the critical folds and some	
	secretory vesicles	13
1.4	Diagram showing mobilization of protein substances within the	
	endoplasmic reticulum during golgi complex activity.	14
1.5	Sketch of golgi complex showing the complamentaliztion	15
1.6	4Pi Photomicroscopy. Mitochondrial network of live budding yeast	
	cell recorded with an MMM-4Pi microscope at an equilateral resolution	
	of~100mm	16
1.7.	Sketch of a complete Kreb (TCA) cycle in a typical cell	17
3.1.	Diagram of a simple microtome showing its principal features.	30
7.1.	Drawing of ultrastructure of striated muscle fibre	56
7.2	Sketch of Actin and myosin filaments strands.	57
7.3.	Neuromuscular junction showing the involvement of the	
	Actin and myosin bridges	57
9.1.	Typical mammalian tooth showing the various anatomical parts	68
9.2	Sketch of a simple monogastric stomach. a-Cardiac region,	
	b-Fundic region, c-pyloric region	71
9.3	Typical stomach of a ruminant	73
9.4.	Sketch of the ruminant stomach showing the various anatomical views.	75
9.5.	Sketch of the digestive system of a typical poultry	76
	Diagram of the external feature of a typical mammalian heart	101
	Diagram of the internal feature of a typical mammalian heart	101
	Typical sketch of the diagram of amphibian heart	102
11.2.	Sketch of a typical mammalian systemic circulatory system	105
12.1.	Typical sketch of the anatomical features associated with respiration	106
12.2.	Hypothetical Basic organization of the respiratory centre Figure	108
12.3.	Sketch of the interaction between the respiratory centres and respiratory or	_
13.1.	Sketch of a typical neuron	111
15.1.	Diagram showing concentration gradient along the loope of Henle	131

LIST OF PLATES

PLA'	TE TITLE	PAGE
3.1	A typical rocking microtome	28
4.1.	Typical tissue processing equipment in a laboratory showing	
	(a) Waxing container, (b) Tissue fixing jar and (c). tissue sectioning machine	. 33
4.2.	Photograph showing laboratory activity of staining procedure and making	
	of permanent slides.	34
5.1	Cross section of slide showing simple epithelial tissues. A. Simple squamous	}
	epithelial cells. B. Simple cuboidal cells and	25
<i>5</i> 2	C. Simple Columnar cells.	37
5.2	Sections of tissue showing different forms of stratified epithelial layer.	
	A. Stratified squamous epithelium; B. Stratified cuboidal epithelial.	38
5.3.	C. Transitional epithelial layer. Various fibre cells present in body tissues.	30
5.5.	(A) Reticular and (B) collagenous fibre	40
5.4.	Section of the adipose tissue with fat cells	43
5.5.	Typical sections of bone cells. (A) Hyaline cartilage and	40
· · · · ·	(B) The haversian system	44
8.1.	Avian and ovine skeletons showing typical appendicular and axial systems.	61
8.2.	Equine skeleton showing typical appendicular and axial systems	62
9.3a	Internal structure of the rumen.	
9.3b.	Internal structure of the abomasum. Note the honey comb appearance.	
9.3c.	Internal structure of the omasum. Note the folded membranes.	
14.1.	Section of the testicles of the goat showing cells of the seminiferous tubules.	116
14.2	Section of the seminiferous tubules showing stratified squamous cells. Plate	116
14.3.	Section of the seminiferous tubules showing isolated cells with simple cuboidal epithelium.	118
14.4.	A pair of ovaries of the goat	118
14.5.	Gravid uterus of the rabbit	119
14.6.	The uterus of the goat showing then complete features	120
14.7.	Section of the ovary of a goat with growing follicle	122
14.8.	Section of the ovary of a goat with growing follicle	123
14.9	Section of the ovary of the goat with luteal cells	124
14.10	Section of the cervix of the goat showing simple columnar epithelium	124
	Hormonal changes in the goat following treatment with three different	
	doses of PMSG	128

LIST OF TABLES

TAB	LE TITLE	PAGE
2.1	Cationic and Anionic concentration	
	in the intracellular (ICF) and	
	extracellular fluid (ECF) of a typical cell	20
2.2.	Ionic concentration and steady State Potential in the muscle	21
7.1	Functional groupings of muscle types	53
10.1	Table showing digestive hormones and their related actions	
14.1	Average duration of cycle and gestation period in various	
	species of domestic animals	121
16.1	Endocrine cell types and their secretion	139