

Recent years have witnessed spectacular advances in our understanding of the molecular mechanisms involved in the pathogenesis of disease processes. This accelerating pace of knowledge necessitated revision and updating of the book. The second edition has been extensively revised and most chapters are completely rewritten. As such, it contains the latest information on molecular pathology. The changes in particular include:

- Incorporation of the most recent information on the molecular mechanisms of disease processes.
- Inclusion of large number of illustrations, 79 in all, for an easy grasp of the complicated molecular mechanisms.
- Keeping in view the Veterinary Council of India (VCI)'s syllabus, a new chapter on 'Concretions' has been added.
- Also, in view of the VCI syllabus, a new sub-topic 'Avian Inflammation' has been added in the chapter on 'Inflammation'.
- The main points are given in bold type.
- In the Index, in case of more page numbers for the same topic, the number that covers the main discussion is shown in bold.

As the book deals with basic pathology, it will be very useful for medical and dental students.

Dr. J.L. Vegad was Professor and Head, Department of Veterinary Pathology at Jawaharlal Nehru Krishi Vishwavidyalaya (JNKVV), Jabalpur. He was then Professor Emeritus of the Indian Council of Agricultural Research (ICAR), New Delhi, for two years. B.V.Sc. (Gold Medalist) from Jabalpur, Associate IVRI (1960), he obtained Ph.D. from New Zealand (1968) under a Commonwealth Scholarship. His contributions to the study of acute inflammatory response in the sheep and chicken are pioneering. He has published more than 150 research papers, 60 of them in British, American, and New Zealand journals. Three of his Ph.D. students got the 'Jawaharlal Nehru Award' of the ICAR. He himself has the distinction of receiving the 'Rafi Ahmed Kidwai Memorial Award' of the ICAR for his outstanding contributions to Veterinary Pathology. Also, he has been honoured as the Best Teacher of JNKVV; with Fellowship of the Indian Association of Veterinary Pathologists; Society for Immunology and Immunopathology; and National Academy of Veterinary Sciences; Dr. C.M. Singh Samman; 'Dr. Nemi Chand Jain Lifetime Achievement Award' of the Indian Association of Veterinary Pathologists (IAVP), and with Dr. J.L. Vegad Foundation under the auspices of IAVP. In 1988-89, he was a Visiting Professor at the University of California, Davis, USA. For ten years he was on the Editorial Board of 'Comparative Haematology International' published from England, and has contributed a chapter on 'buffalo hematology' in the 5th edition (2000) of Schalm's Veterinary Hematology published from USA. For seven years he was President of the Indian Association of Veterinary Pathologists, and is at present Member of the Governing Council of the National Academy of Veterinary Sciences. He is author of five books – three textbooks on veterinary pathology (general, systemic, and special), and two books on poultry diseases, namely, "Poultry Diseases – A Guide for Farmers and Poultry Professionals" and "A Colour Atlas of Poultry Diseases".



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A TEXTBOOK OF VETERINARY
GENERAL PATHOLOGY



Vegad



A TEXTBOOK OF VETERINARY GENERAL PATHOLOGY

Also Useful for Medical and Dental Students

Second Edition



J.L. Vegad



A Textbook of Veterinary General Pathology

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Preface to Second Edition

The widespread popularity of the first edition, both with students and teachers, has prompted me to bring out this Second Edition. I do hope this edition proves equally useful and is received with the same fervour.

Since the first edition was published in 1995, there have been further spectacular advances in our understanding of the molecular mechanisms involved in the pathogenesis of disease processes. This accelerating pace of knowledge necessitated revision and updating of the book. The second edition has been extensively revised and most chapters are completely rewritten. As such, it contains the latest information on molecular pathology. The changes in particular include:

- An effort has been made to incorporate the most recent information on the molecular mechanisms of disease processes.
- For an easy grasp of the complicated molecular mechanisms, a large number of illustrations have been added, 79 in all, in the form of flow charts, line diagrams, and diagrammatic representations of pathological processes.
- Keeping in view the Veterinary Council of India (VCI)'s syllabus, a new chapter on '**Concretions**' (Chapter 12) has been added.
- Also, in view of the VCI syllabus, a new sub-topic '**Avian Inflammation**' has been added in the chapter on '**Inflammation**' (Chapter 4).
- The main points are given in bold type.
- In the Index, where there are more page numbers for the same topic, the number that covers the main discussion is shown in bold.

As the book deals with basic pathology, it will be very useful for medical and dental students.

I am grateful to Mr. Suneel Gomber, Manager, International Book Distributing Co., Lucknow, for the publication of this book. I extend my sincere thanks to Dr. Madhu Swamy for going through the typescript. Dr. Priti Mishra checked the index, while Mr. Anand Parmar and Mr. Vijay Parmar of Jabalpur Graphics were most generous in extending help relating to computer and other work. I am thankful to them all. I am especially grateful to my wife Nita and eldest brother Amrit Lal Vegad for the moral support and for their faith in me and my task.

J. L. Vegad

Preface to First Edition

Recent years have witnessed explosion of knowledge in molecular biology, and consequent thereupon, in the field of molecular pathology. The study of pathology is no longer confined to morphological alterations. Molecular mechanisms involved in the pathogenesis of diseases are being continuously unraveled. No area of pathology has remained untouched by the molecular strides. Since this book deals with General Pathology, that is, study of the basic pathological processes, an attempt has been made to bring out the most recent concepts of molecular mechanisms. For, it is the conceptualization of the underlying principles that is paramount in laying the foundations of systemic pathology, and in fact, medicine as a whole.

The book is intended for both undergraduate and postgraduate students. The undergraduate may, at places, find the text a little too extensive. They are advised to skip these portions. However, should they find the new information rewarding, the idea is to make it readily available at one place. I only hope I could succeed in transmitting the excitement of the remarkable insights gained into the biomolecular origins of disease processes.

The complex mechanisms have been explained in a simplified way using line diagrams, so that they are readily understood. Also, before dealing with the pathogenetic mechanisms, physiological, biochemical, and other related aspects have been briefly reviewed, for an easy comprehension of the subject. Thus, discussion of free radical mediation of cell injury is preceded by a consideration of what free radicals are; or that of mechanisms of healing by an examination of extracellular matrix, or a discussion of thrombosis by a brief consideration of haemostatic mechanisms.

Another feature of the book is that, wherever considered appropriate, aspects of human pathology have been narrated side by side. The text will therefore act as a useful exercise in comparative pathology. As such the book may serve as a good reference for medical, dentistry, and zoology students. In fact, it should prove useful to workers in all branches of science who wish to learn about the basic disease processes.

I am grateful to Dr. S. K. Ranjhan who encouraged me to write this book and to Shri C. M. Chawla of Vikas Publishing House for its publication. It is a pleasure to acknowledge the help of my colleagues

- Dr. A. K. Katiyar, Dr. H. K. B. Parekh, Dr. R. G. Dhawedkar and Dr. B.C. Sarkhel - for their many contributions. Finally, my deepest gratitude to members of my joint family for their patience and understanding. I am especially grateful to my wife Nita and my eldest brother Amritlal Vegad for the moral support, and for their faith in me and my task.

J. L. Vegad,
Department of Pathology,
College of Veterinary Science & A.H.,
Jabalpur - 482001

Abbreviations

AD	=	Anno Domini
ADCC	=	Antibody-dependent cell-mediated cytotoxicity
BC	=	Before Christ
BCR	=	B-cell receptor
BM	=	Basement membrane
CD	=	Cluster of differentiation
CTL	=	Cytotoxic T- cell
DIC	=	Disseminated intravascular coagulation
DTH	=	Delayed-type hypersensitivity
ECF	=	Eosinophil chemotactic factor
ECM	=	Extracellular matrix
EGF	=	Epidermal growth factor
F	=	French
FGF	=	Fibroblast growth factor
G	=	Greek
IFN	=	Interferon
Ig	=	Immunoglobulin
IL	=	Interleukin
IVP	=	Increased vascular permeability
L	=	Latin
LPS	=	Lipopolysaccharide
LT	=	Leukotriene
LX	=	Lipoxin
MAC	=	Membrane attack complex
MHC	=	Major histocompatibility complex
mm	=	Millimetre (thousandth part of a metre)
MPS	=	Mononuclear phagocyte system

μm	=	Micron /micrometre (one millionth of a metre)
NCF	=	Neutrophil chemotactic factor
NK cell	=	Natural killer cell
nm	=	Nanometre (one billionth of metre)
NO	=	Nitric oxide
PAF	=	Platelet activating factor
PDGF	=	Platelet-derived growth factor
PG	=	Prostaglandin
PGI_2	=	Prostacyclin
R	=	Receptor, e.g., IL-2R
TCR	=	T- cell receptor
TGF	=	Transforming growth factor
TNF	=	Tumour necrosis factor
TX	=	Thromboxane
VEGF	=	Vascular endothelial growth factor
vWF	=	von Willebrad factor

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Granulomatous inflammation (Chapter 4) is a distinctive form of mononuclear inflammation. It is usually produced by relatively slowly dividing infectious agents (e.g., *Mycobacterium tuberculosis*, fungi), and by agents of relatively large size (e.g., schistosome eggs). **Granulomatous inflammation almost always reflects a cell-mediated immune reaction** (Chapter 9).

3. Necrotizing inflammation: *Clostridium perfringens* and other organisms that secrete very strong toxins cause such rapid and severe tissue damage that cell death is the main feature. Because so few inflammatory cells are involved, these lesions resemble infarcts, with disruption or loss of basophilic nuclear staining and preservation of cellular outlines. At times, viruses also cause necrotizing inflammation when cell damage is widespread and severe.

4. Cytopathic-cytoproliferative inflammation: These reactions are usually produced by viruses, and are characterized by damage to individual cells, with little or no inflammatory response. Some viruses while replicating within cells make viral aggregates that are seen as inclusion bodies (e.g., Negri bodies in rabies) or induce cells to fuse and form polykaryons (multinucleate cells, e.g., with herpesvirus). Focal cell damage may cause epithelial cells to form blisters (e.g., chickenpox virus in humans). Viruses can also cause epithelial cells to proliferate and take unusual forms (e.g., warts in animals induced by papillomaviruses). Finally, viruses can cause dysplastic changes and cancers in epithelial cells and lymphocytes (see 'dysplasia').

5. Chronic inflammation: The final common pathway of many infections is chronic inflammation, which may lead either to complete healing or to extensive scarring (fibrosis).

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