Fundamentals of
VETERINARY CLINICAL PATHOLOGY

Second Edition
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VETERINARY
CLINICAL
PATHOLOGY

Second Edition

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Writing this second edition was motivated by our desire to synthesize and incorporate newer information related to fundamentals of veterinary clinical pathology, and it was driven by the same goals as the first edition: to explain the physiologic, pathologic, and analytical conditions or disorders responsible for abnormal laboratory data, and to do so using consistent terms and a uniform format. Whenever possible, diseases and conditions are grouped by common mechanisms or processes to promote a conceptual understanding of laboratory data that can be generally applied across many species.

The content of the first edition was largely preserved, but the second edition contains additional disorders, diagnostic tests, illustrations, references, and pathophysiologic explanations. There are four major changes: (1) the analytical aspects in Chapter 2 of the first edition are now distributed into their respective chapters on leukocytes, erythrocytes, and platelets (Chapters 2–4), (2) the Hemostasis chapter of the first edition is split into two chapters, one focused on nonhemostasis aspects of platelets (Chapter 4) and the other on hemostasis (Chapter 5), (3) a new chapter on cavitary effusions (Chapter 19) focuses on the pathophysiologic processes that create cavitary effusions and relates them to inflammatory, renal, hepatic, electrolyte, protein, and lipoprotein disorders, and (4) the color plate section is revised and expanded to include microscopic images of bone marrow, lymph nodes, and cavitary effusions.

Even though the second edition contains more information than the first, it remains focused on disorders occurring in North America and does not address some of the more specialized aspects of veterinary clinical pathology such as therapeutic drug monitoring and molecular diagnostic assays. Coverage of diagnostic cytology is limited because a second volume would be required to do justice to it. Lastly, material is again restricted mostly to dogs, cats, horses, and cattle because these species provide the basis for a fundamental understanding of veterinary clinical pathology.

Regrettably, we will likely uncover mistakes in the second edition as we did in the first. Corrections for these mistakes will be available at this textbook’s Web site (search FVCP Stockham or FVCP Scott), which is linked to the publisher’s Web site and the authors’ Web sites. Also available in the textbook’s Web site are lists of suggested specific objectives that may be used as study guides, and electronic copies of the book’s figures available exclusively for educational purposes.

Once again, we found the writing of the second edition to be a great learning experience and hope that our efforts facilitate the learning of others.
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FIRST EDITION

Many people directly and indirectly assisted in the writing of this book. We thank our fantastic families for providing the never-ending support for our professional pursuits. We thank our excellent veterinary and graduate students for their active participation in their learning—their questions frequently provided stimuli for finding better explanations, and their answers provided insight into what they were or were not learning. We thank our mentors (Drs. Jan Krehbiel, Doug Weiss, Harold Tvedten, and Julia Stickle) and coresidents at Michigan State University, who provided excellent specialty training. We thank Dr. Jenni Donald, who actively participated in the planning, reviewing, and critiquing of chapters. We also thank the technologists in the Clinical Pathology Laboratory at the University of Missouri, and especially Kathy Curtis, MT (ASCP), for helping us pursue many unanswered questions and for documenting certain abnormalities. We also appreciate the assistance of Howard Wilson and Don Connors during the generation of the plates and figures.

The senior author would not have accepted the challenge of writing this text without the persistent encouragement of a longtime friend, colleague, and excellent teacher—Donald A. Schmidt, DVM, PhD, Diplomate, ACVP, Professor Emeritus. Very few people have the opportunity to work with such a great person who was also one of the pioneers in the specialty of veterinary clinical pathology. His statement that “students must come first, they are the reason we are here” provided the justification for many career decisions. For over 25 years at the University of Missouri, veterinary students (and this senior author) were extremely fortunate to have Dr. Schmidt as a teacher.

The specialty in veterinary clinical pathology grew out of the increased use of laboratory tests in veterinary medicine, was promoted in the early 1960s by a society now known as the American Society for Veterinary Clinical Pathology (ASVCP), and then formalized in the early 1970s by the American College of Veterinary Pathologists (ACVP). The authors extend thanks to the ASVCP and ACVP members (and especially charter members and contemporary colleagues) for their leadership, investigations, and instruction. We have made great advances in our understanding of diseases of domestic mammals in the past 40 years, but there are many facts we do not know and processes we do not understand. The clinical laboratories, their dedicated personnel, and their expanding analytical procedures will play a key role in future advances.

SECOND EDITION

We are still greatly appreciative of the many people who directly or indirectly assisted in the writing of the first edition, and we extend sincere thanks to colleagues, students, and family who supported our efforts to produce the second edition. We appreciate the faculty in our departments and colleges who value the scholarly activities of teaching and the writing of a textbook, and we are especially thankful for the unwavering support of our spouses and for the encouraging feedback offered by veterinary students, residents, and fellow clinical pathologists.
Fundamentals of

VETERINARY

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Chapter 1
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Clinical Pathology

I. What is clinical pathology?
   A. Definitions
      1. Pathology is the “branch of medicine that deals with the basis of disease, especially those structural and functional changes in organs and tissues causing or caused by a disease.” In general terms, it is the study of disease.