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BOOK REVIEW...

Biology of Ticks, Daniel E. Sonenshine. Oxford University Press, New York, New York, USA Vol. 1. 1991, 447 pp., $95.00 U.S., Vol. II. 1993, 465 pp., $95.00 U.S.

These companion volumes provide a wealth of well-summarized detailed information from a broad range of current literature as well as insights from the author's considerable experience. In Volume 1, systematics, life cycles, morphology, physiology, and biochemical processes of ticks are presented in a manner that provides a thorough understanding of tick biology. In Volume 2, the author builds on this information and explores the ecology, behavior and host-parasite interactions of ticks, tick-borne and tick-caused diseases, and control of ticks and tick-borne diseases.

Volume 1 comprises 22 chapters and is divided into three major parts. The first Part contains three chapters, the first of which provides an overview of the economic importance of ticks, their general characteristics, and a brief history of research on ticks and tick-borne diseases. In the second chapter, the evolution of ticks and their systematic relationships are discussed with a review of major relevant morphological and biological characteristics of ticks. A clear and simple key to the families and genera of ticks is followed by an overview of each genus with descriptions of morphological characteristics and economic importance. Anatomical terms used in the key are well-defined and illustrated with many high-quality electron micrographs. In the third chapter, developmental patterns of Argasid and Ixodid ticks are presented clearly with numerous examples and original life cycle diagrams.

In Part II, the author covers characteristics of tick body structure with chapters on external anatomy, integument, and general features of internal anatomy. These three highly descriptive chapters of tick morphology are enhanced by excellent diagrams and electron micrographs which provide a solid background for the information presented in Part III.

In Part III (16 chapters), the author focuses on the structure and function of tick body organs and tissues. The processes of blood-feeding and digestion are presented in chapters on the mouthparts and the foregut with considerable detail on the process of attachment and feeding. Chapters cover salivary glands, midgut, hindgut, malpighian tubules and coxal glands, circulatory system and hemolymph, respiratory system, fat body, nervous and neuroendocrine system, sense organs and sensory physiology, female reproductive system, male reproductive system, cytogenetics and genetics of ticks, tick pheromones, embryogeny, endocrine/neuroendocrine regulation and water in balance in non-feeding ticks. The comprehensive review of morphology and physiology in these chapters is enhanced by numerous figures and examples from recent literature.

Volume 1 is targeted towards the advanced student or specialist and should form the basis of a reference library on ticks. It is a highly detailed and useful summary of the current state of tick biology and nicely bridges the gap between existing introductory texts on medical and veterinary entomology or parasitology and advanced reference books on tick ultrastructure and physiology. This volume is enhanced by the numerous comparisons between Ixodid and Argasid ticks as well as between ticks and insects. This volume should be very useful for advanced students, researchers and professionals whose work is complemented by better knowledge of tick biology.

Volume 2 is divided into three parts which continue from the first volume. In Part IV, the author focuses on tick ecology, behavior and host-parasite interactions. In the chapter on the ecology of non-nidicolous ticks (those in the open), ecological adaptations of five representative species of ticks are presented in the context of seasonal activity and adaptations, host-related behaviors, and habitats and distribution. The chapter ends with an overview of population dynamics, population modeling, and predators and parasites. Discussions are not limited to the five species alone and numerous references to other tick species enrich this section. The chapter on nidicolous ticks (those in shelters such as caves, or nests) follows a similar pattern, with specific details provided on six species of endophilous nidicoles (nest-focused) and four species of harborage-infesting ticks. Important in any consideration of tick ecology is the issue of acquired immunity to ticks and in the final chapter of this part, the author reviews immunologic mechanisms allowing vertebrate hosts to resist tick feedings as well as mechanisms of the ticks that compromise host defenses.

In Part V, the author provides detailed coverage of tick-borne and tick-caused diseases in the five chapters on tick-borne diseases caused by protozoa, arboviruses, rickettsia, and bacteria, as well as tick paralysis and other tick-borne toxicoses. In each chapter, the discussion of major tick-borne diseases is presented in the context of history, etiology, clinical features and pathology, ecology and epidemiology, diagnosis

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and treatment, immunity, and treatment and control. These chapters are comprehensive with eight to nine major diseases covered in the chapters on viruses and rickettsioses and three diseases covered in each of the chapters on protozoan and bacterial diseases. Throughout the chapters, minor related diseases also are mentioned. Particular emphasis is given to Lyme disease, both in North America and in other regions of the world.

The chapter in Part VI on control of ticks and tick-borne diseases is thorough and an informative overview of a wide range of control methods is presented. The appendix is devoted to description of laboratory and field methodology for handling and rearing ticks. This section is unique, comprehensive, and should prove invaluable to anyone not familiar with standard methods for dealing with ticks.

Volume II is targeted towards and would be an asset to the advanced student or specialist (such as those in research, public health, veterinary or wildlife services), particularly with interest in ticks as vectors of disease. This volume is unique in the detailed presentation of tick ecology and the detailed review of tick-borne diseases.

Both volumes are well-edited, clearly written, and editorial and factual errors are few. Minor errors include the lack of explanation for numbers on the diagram in Fig A.29 (Vol. 2) and the misspelling of nidicolous in the table of contents of Chapter 23. The use of abbreviations and acronyms as labels in some diagrams may be somewhat distracting; however, on the whole, the author used consistent labeling or abbreviations for diagrams and figures despite the wide variety of published sources. The author notes recent literature designating conspecific status of *Ixodes dammini* and *Ixodes scapularis* and summarizes the literature using the published species names.

These volumes are amply illustrated with over 350 figures in the first volume and 227 figures in the second volume. Many of these are originals and include high-quality electron micrographs, line drawings, tables, and graphs. The bibliography is up-to-date and extensive covering over 450 references in Volume 1 and 700 references in Volume 2. The comprehensive index contains both scientific names and subject headings. Both volumes are fairly costly but cover such a wide range of detailed information that they can serve as important cornerstones in libraries of those individuals or groups with serious interest in ticks and tick-borne disease.

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BOOK REVIEW. . .

Rabies in Bats: Natural History and Public Health Implications, Danny A. Brass, Livia Press, P.O. Box 983, Ridgefield, Connecticut 06877-9998, USA. 1994. 335 pp., $49.95 U.S.

The title of this excellent text is somewhat misleading because it is an exhaustive and able treatise on rabies in all mammals. Dr. Brass, in completing this labor of love begun as a veterinary student, has brought together a wealth of diverse and pertinent information for both medical and nonmedical readers. The depth of coverage and the amount and diversity of new information are impressive. The book progressed far beyond the discussion of bats and rabies that we suspect the author originally intended for spelunkers. In presenting a thorough discussion of the public health implications of rabies in bats, this work employs a very readable text and excellent discussions of rabies in terrestrial animals, rabies-like viruses, current concepts, and rabies pathogenesis. Good use of charts, graphs, and boxed inserts for definitions, clarification, or in-depth discussion further enhance readability. The extensive lists of references found at the end of each chapter are useful for those wanting more details. Sidelights, such as myths associated with vampires and numerous historical quotations, make the book entertaining as well as educational.

The book is divided into five sections: Rabies: Disease and Nature of the Infective Process; Vampire Bats and Rabies in Latin America; Insectivorous Bats and Rabies in North America; Rabies Infection in Old World Bats; and Public Health Concerns. There are 25 chapters, with 11 of them in Section III, Insectivorous Bats and Rabies in North America.

The first chapter is introductory and general in nature, defining terms and presenting a clear, concise description of rabies pathogenesis. Chapter 2 contains an accurate, detailed discussion of current rabies epizootiology in regard to terrestrial carnivores, but the author unfortunately fails to mention the current epizootic involving coyotes and to distinguish between the very different situations involving red versus gray foxes. In Chapter 3, the author discusses rabies in humans, including prevention, wound treatment, and clinical manifestations. Chapters 4 through 10 are an exhaustive review of vampire bat rabies, including considerations of population reduction. The effects of ecologic alterations, such as clear-cutting forests and changes in agriculture, are mentioned as increasing risks to humans from vampire bat rabies, leaving unsaid, but obvious, the implication that other environmental disruptions, such as the wholesale destruction of bats, will also have far-reaching effects. Chapters 11 through 21 include an equally thorough discussion of insectivorous bat rabies in North America. Chapter 19 includes case histories of all confirmed human deaths due to rabies of bat origin. In chapters 22 and 23, the author discusses the emerging recognition of bat rabies in the Old World. In the final two chapters, the public health hazards associated with bats are placed in proper focus: bats can carry rabies, but there is no reason for panic nor justification for destruction of these ecologically important animals.

As one would expect in such an ambitious endeavor, it is not without relatively minor errors. For example, there are at least two references to Parkland County, Texas, which is nonexistent; also a reference to "silver-haired bats" on page 229 would more properly be "a variant associated with silver-haired bats."

Despite minor errors and omissions, however, this remains a most comprehensive and timely work and is a great contribution and a valuable reference for a diverse segment of the population. It is recommended reading for all health officials concerned with bat rabies or any individuals whose occupations or hobbies place them at a higher risk for contact with bats.

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BOOK REVIEW...

Raptor Biomedicine, Patrick T. Redig, John E. Cooper, J. David Remple, and D. Bruce Hunter, editors. Published by the University of Minnesota Press, 2037 University Avenue Southeast, Minneapolis, Minnesota, 55455-3092, USA. 1993. 288 pp., 119 figures, 72 black and white photographs. $39.95 U.S. (Cloth).

Raptor Biomedicine is a refereed collection of papers presented at the Second International Symposium on Biomedical Research in Raptors held in October 1988 in Minneapolis, Minnesota (USA). As the title *Raptor Biomedicine* implies this book was designed to assist both raptor biologist and veterinary practitioners. Thus, papers were contributed from biologists working in the laboratory and field, as well as veterinary clinicians. As stated in the preface this book was also designed to complement the proceedings of the First International Symposium on Raptor Biomedicine (Cooper and Greenwood, 1981). This objective was nicely accomplished in that the current knowledge of most medically relevant issues about raptors is covered between these two works.

The book is divided into five parts; Introduction, Pathology and Microbiology, Surgery and Anesthesia, Medicine and Therapeutics, and Environmental Toxicity. The two introductory chapters written by Drs. Redig and Cooper contain recent progress in raptor biomedicine and the authors emphasize the importance of collaborative efforts between biologists and veterinarians in promoting the welfare and conservation of birds of prey. The authors of these two chapters set the tone for the more technical papers presented in the other four parts.

In part II, Pathology and Microbiology, an emphasis was placed on parasitology with five of the 17 chapters dedicated to parasitic agents. Two chapters on *Staphylococcus aureus* (bumblefoot) and a review chapter on herpesvirus diseases in raptors comprise the other infectious agents presented. Breeding failure and pathological studies of eggs and embryos in captive and wild populations are dealt with in three chapters. This information is complementary to the workshop on captive breeding presented in the proceedings of the first symposium. The remaining chapters are on the use of cytodiagnosis in raptor medicine, pathologic findings associated with neoplasias, fatty liver-kidney syndrome of merlins, studies to elucidate causes of mortality in two raptor species, and the diagnosis of brachial plexus avulsion in owls. Overall, these chapters contain valuable information on a broad range of raptor diseases and the authors emphasize the effects these diseases have on free-ranging raptor populations.

In the third part, surgery and anesthesia, new orthopedic procedures are presented as well as a new technique for the treatment of bumblefoot. An update on the use of inhalant anesthetics in birds of prey is covered in a chapter which includes an extensive bibliography on avian anesthesia. An additional four chapters contain information on physiological effects associated with the use of tiletamine-zolazepam and ketamine-xylazine combinations in various raptor species. The information presented in this part is most applicable for people involved in the direct veterinary care of captive and wild raptors.

The fourth part of the book consists of a variety of papers related to medicine and therapeutics. Topics range from the physiological assessment of flight conditioning of rehabilitated raptors, soft-tissue wound management, treatment of elbow luxations, and physical therapy for specific injuries, to the use of biotelemetry for physiological monitoring, evaluation of the effects of dexamethasone, the treatment of electrocuted raptors, the design of a research hospital, and the use of appetite stimulation for hospitalized patients. The chapter on allometric scaling by Pokras et al. is of particular note and provides valuable information for people working with raptors in rehabilitation centers or veterinary hospitals.

The final part, environmental toxicity, includes three papers on the role of environmental toxins on morbidity and mortality in raptor populations in different regions of the world. The threat of barbiturate poisoning in birds of prey feeding on euthanized livestock, exemplified by mortality in bald eagles, and the background, diagnostics, and therapy of the common pesticides in North America; organochlorines, organophosphates, and carbamates, are presented in two separate chapters. The third chapter is based on two clinical cases and an epidemiological study of 2,750 postmortem cases in birds of prey in The Netherlands. These three chapters remind us that the risks associated with environmental toxins continue to threaten raptor populations throughout the world.

One criticism of the book is the lack of continuity between some of the chapters. For example, in the part on pathology and microbiology, the three chapters related to breeding failure are separated, as are the two chapters on bumblefoot. An editorial mistake noted is a

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mismatch between the dose of xylazine presented in the abstract and materials and method section in the chapter on cardiorespiratory effects of ketamine-xylazine in great horned owls. These two criticisms are minor in comparison to the overall high quality of the papers.

A list of addresses is provided for all the contributors and peer reviewers, as well as biographies on each of the primary authors. It is evident from these lists that contributors work in a variety of regions of the world and possess many specialties; in falconry, rehabilitation, and medicine. These factors are two pluses for making *Raptor Biomedicine* a wealth of information. The book clearly does what the editors intended: it complements the proceedings from the first symposium and should be of interest to biologists and veterinarians alike. Most chapters include an extensive bibliography offering easy assess to additional papers. *Raptor Biomedicine* will be of benefit for biologists, rehabilitators, and veterinarians working with raptors both in captivity and in the wild.

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BOOK REVIEW. . .

Introduction to Animal Parasitology, Third Edition, J. D. Smyth. Cambridge University Press, Cambridge, England, 1994, 549 pp., $47.95 U.S. (Paperback) $130.00 U.S. (Hardcover).

This textbook begins with two chapters introducing parasitologic concepts and definitions. The reader is then taken through a series of chapters on protozoans, flatworms, roundworms and acanthocephalans discussing various representatives of these taxa. Important parasites of humans receive extra attention, although unusual relationships between other hosts and their parasites are also included. There are a good number of examples of parasites in non-human and non-domestic species of hosts presented in many chapters. Basic information is provided on the basic morphology, variations in life cycles, intermediate hosts, and vectors; when appropriate, ultrastructure and nutrition are also addressed. The final two chapters pertaining to in vitro cultivation of protozoans and helminths follow a brief chapter on immunoparasitology.

The information is delivered at a level that should be comprehended by undergraduates. Illustrations are all line drawings and there are no photomicrographs. While this may help hold down costs, micrographs are preferred in some instances such as electron microscopy. The artwork is good quality. The illustrations contribute to clear interpretations of the information presented.

Many references are recent. Some old classics are included as they should be as parasitology is a well established discipline. Too often undergraduate students miss important references because their computer assisted reviews of the literature does not extend sufficiently into our history. Thus it is important to introduce some of the classics in this type of text. The subject index is complete and well developed.

The lack of coverage of ectoparasites is a deficit. Many introductory courses cover external parasites as well as those that occur inside the body. A brief coverage of groups as lice, fleas, mites and ticks and even the dipterans also would have contributed to a better understanding of the discussion of arthropods as intermediate hosts or vectors of the parasites covered in the book.

If I were teaching an undergraduate level parasitology course, I would strongly consider using this reference as the text book.

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BOOK REVIEW . . .

The Wild Turkey (Biology and Management), James G. Dickson, editor. Stackpole Books, P. O. Box 1831, Harrisburg, Pennsylvania 17105, USA. 1992. XV + 463 pp., $49.95 U.S.

This is another excellent book issued by Stackpole Books on an important wildlife species. In this case the publication was sponsored by the National Wild Turkey Federation and the USDA Forest Service and consists of 24 chapters written by 30 specialists, a list of whom reads like a "Who's Who in Wild Turkey Biology." The chapters are grouped into four sections, (1) Wild Turkey Background and History, (2) Wild Turkey Biology, (3) Wild Turkey Habitat and Management, and (4) The Wild Turkey's Value and Future. In addition there are lists of tables, figures, and scientific names of plants and animals cited in the text, a table of contents, a 26-page list of references cited (more than 1,200), a short biography of each author, and a nine-page index. The index is fairly well done, but could have been improved by containing a higher level of detail. The book is well illustrated with nearly 400 black-and-white and 40 color photographs along with a number of line-drawings. Most of the photographs are of good quality whereas some did not reproduce well and lack appropriate contrast. All in all, however, the book is attractive and well produced.

Wildlife disease specialists will especially appreciate several chapters in the Wild Turkey Biology section, namely Chapter 7 (Physiology) by L. H. Blankenship, Chapter 8 (Diseases and Parasites) by W. R. Davidson and E. J. Wentworth, Chapter 9 (Predators) by J. E. Miller and B. D. Leopold, and Chapter 10 (Weather and Climatic Influences) by W. M. Healy. The chapter on diseases and parasites is especially well done and provides an excellent summary of infectious diseases, parasites and parasitic diseases, and a number of noninfectious diseases and miscellaneous conditions including toxicoses and capture myopathy. It concludes with a section on disease problems associated with pen-raised turkeys and the dangers encountered when these birds are released into wild turkey habitat. Infectious diseases considered include avian pox, viral neoplasms, mycoplasmosis, salmonellosis, coligranuloma-like diseases, avian chlamydiosis, aspergillosis, and several other bacterial, rickettsial, and fungal infections. Discussions of parasites and parasitic diseases are accompanied by five tables in which are given various details on the location in the host, vectors or intermediate hosts involved, pathogenicity, and geographic distributions for the protozoans, trematodes, cestodes, nematodes, acanthocephalans, and arthropods associated with wild turkeys. Sixteen color plates are used to illustrate some diseases and parasites.

Those individuals working with galliform birds, especially wild turkeys, will find this book indispensable. It will no doubt become *the* classic reference on wild turkeys and is well-worth the price.

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BOOK REVIEW . . .

Investigation and Management of Disease in Wild Animals. Gary A. Wobeser. Plenum Press, 233 Spring Street, New York, New York 10013, USA. 1994. 265pp. $59.50 U.S.

This book is the first scholarly treatise broadly addressing disease management in free-living wildlife populations. As such, the author has made a major contribution to the field by providing a conceptual framework for wildlife disease investigations and by highlighting the inadequacies that often exist. His willingness to challenge dogma and constructively present perspectives based on a combination of extensive literature review, personal experiences, and beliefs is one of the values of this well organized and easy to read publication. However, in stressing the need for highly organized and designed investigations the author does not adequately address the circumstances that inhibit such investigations. As a result some readers based on their own personal experiences are likely to differ with some of the author's perspectives. Other readers may view some of the statements of the shortcomings of wildlife disease investigations as a negative representation of the wildlife disease field. Nevertheless, this publication should be read by biologists, administrators, and disease specialists having responsibility for combating disease in populations of free-living wildlife. The content provides new wildlife disease investigators with a good introduction to the field and a valuable outline for guiding their personal efforts. Many of the examples discussed involve environmental contaminants. Therefore, contaminant assessment biologists will also find this publication useful. In addition, this publication provides a framework for a semester course on wildlife disease investigations and management.

The 231 pages of text are organized into 17 chapters within three sections. The text has a page size of approximately 16 × 25 cm and is durably bound in hard cover. The 21 pages of literature citations are a major contribution in itself and includes citations that may have escaped the attention of some investigators due to publication in other countries and in fields other than wildlife diseases. Other strengths relative to the presentation of information include clear examples to illustrate key points and the summary provided at the end of each chapter. Illustrations and tables are used sparingly. There are no photographs; figures (17) are found in only seven of the 17 chapters and there are only six tables included to supplement the text material. Some information also is presented as statistical formulas. A number of editorial errors exist that should be corrected by issuance of an errata. These include numerous citations in the text that do not appear in the References section, one segment of a figure referred to in the text is missing and another figure cannot be interpreted easily because the black and white format does not provide for separation of key information within that figure.

In Section I (Introduction), a general foundation is provided for the remainder of the book. A basic tenet advanced in Chapter 1 (Disease and Epizootiology—Basic Principles) is that disease in wild populations is generally a multi-factorial process. In support of this tenet, a web of interrelatedness factors that may be associated with disease and criteria for establishing causation are discussed. Examples are presented to illustrate the difference between enzootic and epizootic disease and to define differences between measurements of disease prevalence and incidence. Chapter 1 also establishes the general focus on statistical evaluations found throughout the book and concludes with sound advice regarding the need to assure that measurements of statistical significance have biological relevance. Chapter 2 focuses on problems in working with free-living animals. The primary problems discussed are the detection of diseased animals, determining population size and identifying individual animals, shortcomings in knowledge regarding the basic biology of many wildlife species, the diversity and intractable nature of wild animals, and problems related to people. The problems discussed are appropriate and raise sensitivity about these matters. However, the tone of the chapter conveys a somewhat negative perspective about the value of wildlife disease investigations.

Section II (Disease Investigations) has seven chapters. Chapter 3 is devoted to principles of epidemiology and the definition of terms. Examples given allow the reader to easily visualize the material presented. Chapter 4 (Collecting Population Data) addresses counts of animals and population estimates including vital statistics. The application to disease investigations of standard population measurement techniques used by wildlife biologists is stressed. Carcass disappearance rates and other biases affecting the accuracy of counts and population estimates are a focal point throughout the chapter. Chapter 5 (Defining Environmental Factors) is a good summary of environmental factors, including human impacts, influencing the occur-

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rence of disease. The chapter serves as a reminder of the importance of environmental factors and may broaden the perspectives of some readers. In addition, readers are provided a good entry to the scientific literature associated with the roles of the various factors cited. Chapters 6 and 7 are focused on statistical methods and provide fundamental perspectives of information. Formulating and testing hypotheses is the focus for Chapter 6 while sampling procedures and sample collections are addressed in Chapter 7. Both chapters serve as refreshers of concepts that for some investigators may have faded over time. Those not readily conversant with statistical methods will gain a better understanding of how to interpret data associated with disease events. Chapter 8 addresses records and record keeping and is an excellent common sense guide for making the process easy and for providing useable data. If followed, the guidelines presented assure the value of future evaluations involving data collected over time. The final chapter of Section II provides a good outline for investigations of disease epizootics and chronic or inapparent disease (Chapter 9).

Disease Management is the focus for the final eight chapters (Section III) and begins with a presentation on general principles (Chapter 10). This is the first time the viewpoint is expressed that something meaningful can be done to address disease in wildlife populations. The following five chapters are devoted to disease management by addressing the causative agent/factor or its vector (Chapter 11), manipulations of the host population (Chapter 12), treatment and immunization (Chapter 13), environmental modification (Chapter 14), and influencing human activities (Chapter 15). The last of these chapters is focused on human movement of animals as a factor in disease spread. The book concludes with chapters addressing emergency and integrated management programs (Chapter 16) and assessment of the effectiveness of disease management programs (Chapter 17). The final chapter begins with a statement in the first paragraph that, "It is fair to characterize almost all methods currently in use for disease management in wild animals as being of unproven and untested efficacy." The remainder of the chapter focuses on how to approach assessments, including economic evaluations of cost : effectiveness and benefit : cost analysis, and concludes with a consideration of predictive models.

This publication is not a techniques manual or field guide that can be used by non-specialists to address management of disease in free-living wildlife. It is primarily a concept document that provides good packaging and presentation of basic information for the development of programs and studies to address wildlife diseases. The experienced investigator will find little new information, but may benefit from revisiting the concepts displayed. The new investigator will find a wealth of information. All should find this publication to be of value.

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