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Foreword by Frank Jordan

poultry diseases

6th Edition

Now in its sixth edition, Poultry Diseases is once again fully revised with the addition of vital new material. It remains the standard reference work on health and disease for those involved in the poultry industry, government and veterinary education. Following a familiar structure, readers of the sixth edition gain concise but major reviews of current knowledge of general and disease-specific topics discussed over 45 chapters (5 new) in 7 sections. The first of the new chapters occurs in the General Overview section and covers laboratory investigation supporting health programmes and disease diagnosis. In the Bacterial Diseases section, the reclassification of organisms of 'Pasteurella type' is brought up to date with a new introductory chapter on infections caused by species of Pasteurellaceae, Ornithobacterium and Riemerella and subsequent chapters on Gallibacterium and Riemerella infections. This section also includes a new chapter on Erysipelothrix rhusiopathiae. A further new chapter covers practical aspects of the epidemiology of poultry disease and multifactorial conditions. In addition to the new chapters, original chapters have undergone major reviews. Most notably, the chapter on avian influenza discusses the substantial changes in epidemiology of this condition, its importance for avian and human medicine, and knowledge of the causative viruses.

Features:

- Covers common and rarer diseases found in all species of poultry (including chickens, ducks, turkeys, game birds and guinea-fowl)
- Each chapter outside the General Overview section identifies clearly epidemiology, clinical signs and differential diagnosis, pathogenesis, treatment and control. Systems chapters discuss disorders of selected body systems in detail, leading to differential diagnosis of the specific disorder
- An appendix of useful data
- Worldwide coverage from a recognized international team of editors and contributors.

New to this edition:

- 5 new chapters and major chapter revisions on biosecurity in poultry management, avian influenza, legislation and poultry welfare
- New contributors and 2 new prominent editors make up a 4-strong editorial team
- 100 illustrations
- Viral chapters now include information on zoonoses.

With a large international team of contributors led by an authoritative editorial team and a foreword by Professor Frank Jordan, Poultry Diseases is an invaluable resource for the practising veterinarian, poultry inspector, agricultural manager or veterinary student.

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ELSEVIER

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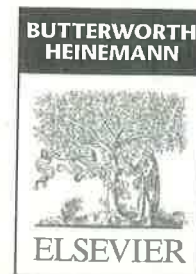
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This edition of Poultry Disease, 6e by Mark Pattison, BVSc, MSc, PhD, MRCVS, Paul McMullin, MVB, DPMP, MRCVS, Janet M. Bradbury and Dennis Alexander, BTech, PhD, MRCPath, CBiol, FIBiol, DSc is published by an arrangement with Elsevier Limited.

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NOTICE

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our knowledge, changes in practice, treatment and drug therapy may become necessary or appropriate. Readers are advised to check the most current information provided (i) on procedures featured or (ii) by the manufacturer of each product to be administered, to verify the recommended dose or formula, the method and duration of administration, and contraindications. It is the responsibility of the practitioner, relying on their own experience and knowledge of the patient, to make diagnoses, to determine dosages and the best treatment for each individual patient, and to take all appropriate safety precautions. To the fullest extent of the law, neither the Publisher nor the Authors assumes any liability for any injury and/or damage to persons or property arising out of or related to any use of the material contained in this book.

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FOREWORD

The principal objective of those who have been involved in preparing this edition of *Poultry Diseases* continues to be to provide an up-to-date and concise account of the more common diseases of poultry and of the factors that are important in supporting optimal production.

The first edition was published under the editorship of the late Bob Gordon in 1977 and the regular production of new editions since that time is a reflection of the rapid changes and advances that have taken place in poultry production and in the understanding and control of disease. The use of molecular techniques for rapid diagnosis, for epidemiological tracing and for improved vaccine production is one of the factors that have accelerated the pace of these advances. In addition, greater attention is being given to zoonotic infections, to the advantage of the consumer. The benefits seen by the industry over recent years have been a marked increase in production performance and feed conversion throughout the world and, in many areas, a greater contribution to the quantity and quality of the human food supply. However, there are still challenges to be met. For example, problems have emerged in the control of certain diseases in some countries since the removal of effective drugs.

The editors and contributors to this book are active and renowned in their particular fields and have produced an updated edition that serves a highly useful purpose in providing the latest information on poultry disease and its control.

Frank Jordan

PREFACE

The purpose of *Poultry Diseases* is to provide a standard reference work on health and disease for those involved in the poultry industry.

This book includes information that is relevant to veterinary and agricultural students and their teachers, veterinarians in government and practice, and management staff involved in poultry companies. This is now the sixth edition of the book first edited by the visionary Dr R. F. Gordon in 1977. Its continued success has been a tribute to the zeal, tenacity and scientific standing of Professor Frank Jordan. This is the first edition where he has not been senior editor and the four of us are privileged to continue as his successors.

The poultry industry is very important to the world agricultural economy, and technological innovation has greatly improved the efficiency of poultry production, especially in relation to housing, nutrition, genetics and health management. Hence it was considered necessary to update the content of this book without fundamentally changing its format. For example, the chapter on avian influenza has been expanded and the welfare chapter has been extended to include the European situation. In the bacteriology section, the reclassification of organisms of '*Pasteurella* type' is brought up to date. The importance of biosecurity is now well understood by industry and governments and this is reflected by a complete revamp of the chapter on hygiene.

We would like to acknowledge the helpful suggestions and assistance of numerous colleagues in the production of this new edition.

Carnforth, Thirsk, Liverpool and Addlestone 2007

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FURTHER READING

- Akester A R 1971 The heart. In: Bell D J, Freeman B M (eds) *Physiology and biochemistry of the domestic fowl*, vol 2. Academic Press, London, p 745–781
- Anon 1987 Guidelines for the care of laboratory animals and their use for scientific purposes: 1 housing and care. Royal Society and Universities Federation for Animal Welfare, London
- Code of Accepted Farming Practice for the Welfare of Poultry. State of Victoria, Department of Natural Resources and Environment, PO Box 500, East Melbourne, VIC 3002, Australia
- Department for Environment, Food and Rural Affairs 2002 Code of recommendations for the welfare of livestock – laying hens. DEFRA, London
- Department for Environment, Food and Rural Affairs 2002 Code of recommendations for the welfare of livestock – meat chickens and breeding chickens. DEFRA, London
- Ewbank R, Kim-Madslien E, Hart C B (eds) 1999 *Management and welfare of farm animals*. 4th edn. Universities Federation for Animal Welfare, Wheathampstead
- Farm Animal Welfare Council 1991 Report on the welfare of laying hens in colony systems. PB 0734. MAFF, Surbiton
- Farm Animal Welfare Council 1992 Report on the welfare of broiler chickens. PB0910. MAFF, Surbiton
- Farm Animal Welfare Council 1995 Report on the welfare of turkeys. PB2033. MAFF, Surbiton
- Farm Animal Welfare Council 1997 Report on the welfare of laying hens. PB3221. MAFF, Surbiton
- Farm Animal Welfare Council 1998 Report on the welfare of broiler breeders. PB3907. MAFF, Surbiton
- Freeman B M 1971 Biochemical and physiological data. In: Bell D J, Freeman B M (eds) *Physiology and biochemistry of the domestic fowl*, vol 5 appendix. Academic Press, London
- HMSO 1987 *Animals prevention of cruelty: the Welfare of Battery Hens Regulations*. HMSO, London
- Kouwenhoven B 1993 Environment, husbandry, genetic and nutritional interactions in infectious diseases in poultry. In: *Proceedings of the Xth World Veterinary Poultry Association Congress*, Sydney, p 113–126
- Ministry of Agriculture, Fisheries and Food 1987 Codes of recommendations for the welfare of livestock – ducks. MAFF, London
- Ministry of Agriculture, Fisheries and Food 1987 Codes of recommendations for the welfare of livestock – turkeys. MAFF, London
- Ministry of Agriculture, Fisheries and Food 1988 Codes of recommendations for the welfare of livestock – domestic fowls. Leaflet 703. MAFF, London
- Stationery Office 2002 *The Welfare of Farmed Animals (England) (Amendment) Regulations*. Stationery Office, London
- DEFRA websites relating to the welfare of:**
Laying chickens: <http://www.defra.gov.uk/animalh/welfare/farmed/layers/index.htm>
Meat chickens: <http://www.defra.gov.uk/animalh/welfare/farmed/meatchks/index.htm>

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