BIRDS
their structure
and function
SECOND EDITION

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Preface

This book was first envisaged as a second edition of *Outlines of Avian Anatomy*. However, as the rewriting progressed our objectives widened, and this is reflected in the more general title that the book now carries. Originally, the main purpose of 'Outlines' was to meet the needs of university students and those who taught them, with particular attention to veterinary requirements; the interests of ornithologists took second place. The present volume is designed equally for the ornithologist on the one hand, and those engaged in university studies, research, or veterinary practice on the other. This has not resulted in any reduction in material utilized in university work, veterinary or otherwise. On the contrary such aspects have been up-dated and augmented by the results of recent research.

Much the greatest development in this new book has been the addition of many topics of interest to ornithologists. Among these is a detailed account of the external features essential for the identification and description of birds, including surface markings, variations in the beak and feet, and the structure and modifications of wings. We have also set out to supply the answers to questions which ornithologists often ask from their intense curiosity about birds. What is the anatomical basis of flight? How is it possible for a bird to perform the hard work of flying at high altitudes and over immense distances? What is the mechanism of voice production? Do birds see and hear better than we can? How good is their sense of smell? How do they navigate? Advanced scientific knowledge is not needed in order to follow the essential principles behind these problems. Some subjects are of course inevitably more complex, for example aspects of the nervous system, and here we have written for the more advanced reader.

A particular feature of the new book is the improved quality of the illustrations, all of which have been redrawn by a professional artist, Garry Martin. The references at the end of each chapter have been expanded to provide much more extensive sources than before. The anatomical nomenclature is now firmly based on the Nomina Anatomica Avium, 1979, the Latin terms being converted into their English equivalents. The scientific taxonomic nomenclature is that prepared by J. J. Morony, W. J. Bock and J. Farrand and published by the Department of Ornithology of the American Museum of Natural History, New York, in 1975. The English names of birds are those
listed by E. S. Gruson in his Check List of the Birds of the World, Collins, London, 1976. The names of the common laboratory and domestic birds are as follows: duck, domestic forms of Anas platyrhynchos; goose, domestic forms of Anser anser; pigeon, domestic forms of Columba livia; turkey, domestic forms of Meleagris gallopavo; chicken or domestic fowl, domestic forms of Gallus gallus; quail, domestic forms of Coturnix.

We have had so much help from so many sources that it seems invidious to mention any particular individuals. We must, however, thank Mrs M. M. Thompson for typing the manuscripts and Mr M. Goldberg for photographing much of the artwork. Many biologists and publishing firms have generously allowed us to utilize their illustrations, and we are particularly indebted to Dr J. J. Baumel of Creighton University, Nebraska, Dr V. Komárek, Prague, and our Japanese colleagues, Professors M. Yasuda and T. Watanabe of Nagoya University. Scientific information has been drawn extensively from the literature, but we also acknowledge the particular stimulus of the very original Master's thesis by Dr Pat McCarthy, of the University of Sydney.

A. S. King
J. McLelland
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Chapter 1

BIRDS

The evolution of birds

The earliest known bird was Archaeopteryx. Five almost complete fossils of this ancient bird have been found in late Jurassic limestone about 150 million years old. As Fig 1–1 shows, these fossils coincide roughly with the middle of the 130 million year period of domination by the archosaurian reptiles, of