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P. T. Marshall and G. M. Hughes  
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# Physiology of mammals and other vertebrates

*Second edition*

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## Preface to the second edition

Since the first edition was published in 1965 there have been considerable advances in knowledge and understanding of physiology. This edition incorporates new findings, changes of emphasis and new directions in the comparative physiology of mammals and other vertebrates.

Thus while the general aims and organisation of the work remain largely the same as set out in the preface to the first edition, new knowledge and understanding have necessitated a thorough reassessment of the text.

The immediate changes will be seen in the depth of treatment of homeostatic mechanisms and of coordination and in the details of biochemistry and function at the level of the cell. The extensive use of the dogfish and the frog as 'set' types has been changed and much more use is made of comparative data from a wide range of non-mammalian vertebrates. The final chapter on reproduction has been greatly extended.

While the major rewriting of the text has been carried out by Peter Marshall, the co-author, Professor George Hughes, has read and commented on all the new material. For specialised sections we are grateful to Dr Robert Reid of the University of York for his comments on the cell biochemistry, to Dr David Aidley of the University of East Anglia and Dr Ian A. Johnston of the University of St Andrews for their help with the section on muscles, and to Dr Barry Roberts of the Plymouth Laboratory for his further help with the revision of the chapter on nervous coordination. Dr D. Brown of Addenbrooke's Hospital, Cambridge, was of great help in interpreting recent theories relating to immunity. Dr Peter Hogarth of the University of York has also read and made many helpful comments on the whole of the current text.

The checking and editing of this edition have been a formidable task and we are particularly indebted to Mrs Jane Farrell of the Cambridge University Press for her expert work in this respect. Many of the new drawings and diagrams, which form an important feature of the new edition, are the work of John Fuller and to him we also express our thanks.

*August 1979*

P.T.M.  
G.M.H.

## Preface to the first edition

Biology is a very large and varied subject which may be subdivided in many different ways. A common and usual one is to consider living organisms at a series of different levels, beginning with whole populations, then at the individual, organ system, tissue, cellular and molecular levels. Throughout the history of biology there have been changes in the particular level which has received most study and also shifting fashions in the approach to a given or to several levels which were in vogue at that particular time. Often these fashions can be related to developments of new techniques which require the repetition and interpretation of previous work. Some aspects of the biological approach remain constant despite these winds of change and one of these is the relation between structure and function. This relationship can be discussed at all levels of organisation and it is basic to the approach given in this book.

A great deal of this approach tends to be at the organ system level and as such continues to present problems to the biologist, but at the present time there is a great deal of emphasis at a molecular level so that no modern functional approach to the subject would be complete without some inclusion of the biochemistry of cellular activities. In this field we try to present a brief account of the rapidly expanding aspects in the context of more classical biology and to emphasise some of the principal biochemical processes rather than give a detailed account of metabolic pathways. Here, as well as elsewhere in the book, space has not been sufficient to allow a critical approach, and while much of the anatomical and physiological material is now well established the same is not necessarily true of the most recent biochemical work.

Despite the interest and importance of cellular function much of it is hardly suitable for teaching or demonstration to elementary classes and it is the physiological approach to the vertebrates that forms, and is likely to form, the bulk of first courses in animal biology. It is the experience of the authors and many others in teaching biology to sixth-formers and students at university that few recent textbooks have attempted to summarise in an elementary way the vast knowledge gained by mammalian physiologists. Although basically this is a textbook of physiology it differs from most standard texts in that it has not been written primarily for medical students. Because of this, much comparative material, both anatomical and physiological, has been included. Relatively large

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amounts of anatomical material are included in order to emphasise to the student the importance of considering form and function together and not in isolation from one another. Furthermore, comparative material has been included to show the need for further investigation in this sort of study, both for its own sake and also because of the light it may shed on the functioning of mammals. The value of close understanding between comparative physiologists, mammalian physiologists and clinical physiologists is apparent at the research level at the present time and perhaps, by emphasizing this in the early training of all three types of student, we may hope to encourage such co-operation further.

The presentation of such an integrated approach abounds with problems and we are aware that what is given here contains many faults both in detail and in its general attitudes. It is, however, because we believe there is a great need for integration at this level of teaching that we have thought such an attempt to be worth while. We also know that there are many others who are far more qualified to write a book of this sort than ourselves and hope that if any of them should read our attempt they will be good enough to let us know where they think we have made errors. Some of the information has been presented in a diagrammatic way which has inevitably required a great deal of simplification. We only hope that the simplifications that we have made and the selection of data presented will not give rise to any fundamental misconceptions at this elementary stage of teaching.

In summary then, we hope to have shown the relevance of the study of vertebrates in the A level syllabuses to the potential medical student or biologist. The major object of the book is to present data in a way which will prepare the sixth-former for the type of functional approach he will have at the university.

Because of our awareness of the great breadth of the field that is covered in this book we have sought advice from many people whom we should like to thank. First of all, we should particularly like to thank Dr George Salt for suggesting the cooperation between ourselves, and for his constant advice during the production of this book. We are grateful to Dr W. E. Balfour of the Physiological Laboratory, Cambridge, for reading through the whole typescript. Individual chapters have been read by several of our friends, including that on the endocrine system by the late Dr H. E. Tunnicliffe; that on disease by Dr F. E. Russell; on excretion by Dr A. P. M. Lockwood; and on the nervous system by Dr B. M. H. Bush. Much of the biochemical work was read critically by Dr R. Gregory of the Biochemistry Department. The diagrams of the cell and mitochondrion were devised by Dr A. V. Grimstone. We also wish to thank Mr B. Roberts for his helpful comments on the proof.

Throughout the many problems that have arisen during publication we have had much help from the editorial staff of the Cambridge University Press, to whom we would like to express our thanks.

We believe that an important feature of the book is the original

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drawings of histological and skeletal material made available by several laboratories, including Anatomy, Physiology and Zoology. The drawings were done by T. W. Armstrong, while still a pupil at The Leys School, and to him we would like to express our thanks.

*August 1964*

G.M.H.  
P.T.M.