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Textbook of Zoology Invertebrates

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This is the Seventh Edition of *Textbook of Zoology*, Vol. I

by the late T. JEFFERY PARKER and the late WILLIAM A. HASWELL

ENGLISH LANGUAGE BOOK SOCIETY

and

MACMILLAN EDUCATION

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First Edition 1898

Second Edition 1910

Third Edition 1921

Fourth Edition 1928

Fifth Edition 1930

Sixth Edition 1940

Seventh Edition 1972

Reprinted 1974, 1978, 1979, 1982

ELBS edition first published 1972

Reprinted (with corrections) 1974, 1975, 1977, 1978, 1979, 1982, 1985

Published by

THE MACMILLAN PRESS LTD

London and Basingstoke

Companies and representatives

throughout the world

ISBN 978-0-333-17868-3 ISBN 978-1-349-02495-7 (eBook)

DOI 10.1007/978-1-349-02495-7

ELBS edition: ISBN 978-0-333-14107-6 (paper cover)

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PREFACE TO THE SEVENTH EDITION

It is possible to argue that when a book first published in 1898 reaches its sixth edition it is perhaps better from a number of considerations not to prepare a seventh. That this argument has not been sustained for Parker and Haswell's *A Textbook of Zoology* is due to several reasons. The principal one is that the need still persists for a comprehensive English-language text which treats the subject in an inductive fashion, using for the most part detailed 'type' descriptions as a basis for introducing more comparative detail. Without a seventh edition of this book, the need would be largely ignored.

It may be stressed that considerable differences occur between this edition and the previous one, so much so that in effect most of the text is new with many chapters being entirely original. Indeed, each chapter has been revised or entirely rewritten by a different author or authors (there are eighteen in all) in order to provide as modern and as authoritative an account as possible. In selection of authors, there was some conscious effort to maintain the antipodean flavour of the original edition, but this was not at all restrictive, and authors reside in the four major English-speaking areas of the world: Britain, North America, Australia and New Zealand. Inevitably, of course, this has led to minor differences in approach and style, but such differences have not altered significantly the general overall structure of the book. Almost all drawings have been prepared afresh. A list of references has now been added.

This edition was first planned and initiated by the late A. J. ('Jock') Marshall, Foundation Professor of Zoology at Monash University, whose death in 1967 was a great loss to Australian biology. That I have been happy to shoulder the remaining tasks of editorship may be taken as a small tribute of my respect for him as a scientist and man.

W. D. WILLIAMS

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ACKNOWLEDGEMENTS

Without the cooperation and help of a great number of people the production of so large a multi-authored book as this would not have been possible. To all, sincere thanks are tendered. In particular, the final editor expresses thanks to the following: to the authors for their patience, forbearance and continued enthusiasm; to several scientific editors of Macmillan and especially Mr John Maddox, Miss Elizabeth Johnston and Mr Charles Fry, for their careful editing of original manuscripts; to Mrs Jane Marshall, Miss Dinnie Mackay and the London artist of the publishers for art work; to several anonymous readers of the original manuscripts whose comments, while not always accepted, were invariably constructive and helpful; to the many publishers who gave permission to reproduce copyrighted illustrations (acknowledged in detail in figure captions); to Mr B. Hazell and Mrs T. McConnell for typing and secretarial assistance; to Mr Peter Ebsworth for help in the preparation of the index; and finally, but not least, to Professor J. W. Warren, Chairman, Department of Zoology, Monash University for allowing wide use of university facilities.

Some specific acknowledgements are also tendered by authors. Professor Sprent thanks Mr J. V. Hardy of the University of Queensland Electron Microscope Centre for photography (Plate IV). Dr Pawson thanks Dr Robert P. Higgins, Wake Forest College, North Carolina, U.S.A., for constructive criticism of the section on the Kinorhyncha. Dr Williams thanks Professor H. B. N. Hynes, Department of Biology, University of Waterloo, Ontario, Canada, for comments on the crustacean section. And Dr Hiscock thanks Dr D. F. McMichael, National Parks and Wildlife, New South Wales, for comments on the molluscan section.

CLASSIFICATION OF THE ANIMAL KINGDOM

In several places, the classification given here differs from many given elsewhere. In part, this is a reflection of our increased knowledge about certain groups, and partly, also, of increased dissatisfaction with traditional systems that uncritically accepted viewpoints on matters of some debate and were based on criteria now known to be unreliable. The reader's attention may be drawn to the following points in particular, for all of which further explanation is offered in the body of the text.

The classification of the Protozoa is in such a state of flux that it is felt that no formal system for the higher classification of this group can presently be offered with any assurance of stability. The Porifera is regarded as a true metazoan phylum and not as a sub-kingdom separate from the Protozoa and Metazoa. The Priapulioidea, which it now appears have a coelom, have been removed from the Aschelminthes and given the status of a separate phylum. The higher classification of the Arthropoda given is only one of several currently in vogue; it represents the one which found greatest acceptance among the authors contributing to this section of the book. And finally, the higher classification of the Echinodermata given is quite different from the principal current one, but strong arguments can be advanced in its favour.

In addition, it should be noted that the phylum Archeocyatha which is not referred to in the body of the text is included in the classification below for the sake of completeness. It is completely extinct and known only from fossils of Cambrian age. Formerly classified within the Porifera, the archeocyaths were less differentiated than sponges, but more highly organized than the Protozoa. Not referred to either in the text or in the classification below is the Gnathostomulida, a small extant group of aberrant organisms variously regarded as an order within the Turbellaria, a class within the Platyhelminthes, or a separate phylum.

SUB-KINGDOM PROTOZOA

FLAGELLATES

(Includes: chrysomonads, cryptomonads, euglenoids, phytomonads, dinoflagellates, monadarians, choanoflagellates)

RHIZOPODS

(Includes: naked and testate amoebae, heliozoans, radiolarians, foraminiferans)

GREGARINES

(true gregarines, schizogregarines)

COCCIDIANS

HAEMOSPORIDIANS

CNIDOSPORIDIANS

(Includes: myxosporidians, actinomyxidians, microsporidians)

CILIATES

(Includes: holotrichs [gymnostomes, hymenostomes, thigmotrichs, peritrichs, trichostomes, suctorians], spirotrichs [heterotrichs, tintinnids, hypotrichs, entodiniomorphids])

OPALINIDS

SUB-KINGDOM METAZOA

PHYLUM ARCHEOCYATHA

PHYLUM PORIFERA

Class Calcarea

Sub-class Calcaronea

Order Leucosolenida

Order Sycettida

Classification of the Animal Kingdom

- Sub-class Calcinea
 - Order Clathrinida
 - Order Leucettida
 - Order Pharetronida
- Class Hexactinellida
 - Sub-class Hexasterophora
 - Sub-class Amphidiscophora
- Class Demospongiae
 - Sub-class Tetractinomorpha
 - Order Homosclerophorida
 - Order Choristida
 - Order Epipolasida
 - Order Hadromerida
 - Order Axinellida
 - Order Lithistida
 - Sub-class Ceractinomorpha
 - Order Halichondrida
 - Order Poecilosclerida
 - Order Haplosclerida
 - Order Dictyoceratida
 - Order Dendroceratida

PHYLUM CNIDARIA

- Class Hydrozoa
 - Order Hydroida
 - Sub-order Anthomedusae (Athecata)
 - Sub-order Leptomedusae (Thecata)
 - Order Trachylina
 - Sub-order Trachymedusae
 - Sub-order Narcomedusae
 - Order Hydrocorallina
 - Order Chondrophora
 - Order Pteromedusae
 - Order Siphonophora
 - Order Graptolithida
 - Order Stomatoporoidea
- Class Scyphozoa
 - Order Stauromedusae (Lucernarida)
 - Order Coronatae
 - Order Cubomedusae
 - Order Semaestomeae (Discomedusae)
 - Order Rhizostomeae
- Class Anthozoa
 - Sub-class Hexacorallia (Zoantharia)
 - Order Actiniaria
 - Order Madreporaria
 - Order Zoanthidea
 - Order Antipatharia
 - Order Ceriantharia
 - Order Corallimorpharia
 - Order Ptychodactiaria

Classification of the Animal Kingdom

Sub-class Octocorallia (Alcyonaria)

- Order Stolonifera
- Order Telestacea
- Order Alcyonacea
- Order Coenothecalia
- Order Gorgonacea
- Order Pennatulacea

PHYLUM CTENOPHORA

Class Tentaculata (Micropharyngea)

- Order Cydippidea
- Order Cestidea
- Order Lobata
- Order Platyctenea

Class Nuda (Macropharyngea)

- Order Beroidea

PHYLUM MESOZOA

- Order Dicyemida
- Order Orthonectida

PHYLUM PLATYHELMINTHES

Class Turbellaria

Sub-class Archoophora

- Order Acoela
- Order Polycladida

Sub-class Neoophora

- Order Rhabdocoela
- Order Temnocephala
- Order Tricladida

Class Digenea

Class Aspidogastrea

Class Monogenea

- Order Monopisthocotylea
- Order Polyopisthocotylea
- Order Gyrocotylidea

Class Cestoda

- Order Caryophyllidea
- Order Spathebothridea
- Order Diphyllbothridea
- Order Bothriocephalidea
- Order Tetrphyllidea
- Order Trypanorhyncha (Tetrarhynchidea)
- Order Proteocephalidea
- Order Cyclophyllidea

PHYLUM NEMERTINI

Sub-class Anopla

- Order Palaeonemertini
- Order Heteronemertini

Sub-class Enopla

- Order Hoplonemertini
- Order Bdellonemertini

Classification of the Animal Kingdom

PHYLUM ASCHELMINTHES

- Class Nematoda
- Class Nematomorpha
- Class Rotifera
 - Order Bdelloida
 - Order Seisonoida
 - Order Monogonontida
- Class Gastrotricha
 - Order Macrodasoyida
 - Order Chaetonotoida
- Class Kinorhyncha
 - Order Cyclorhagida
 - Order Homalorhagida
 - Order Conchorhagida

PHYLUM ACANTHOCEPHALA

PHYLUM ENTOPROCTA (KAMPTOZOA, CALYSSOZOA)

PHYLUM ANNELIDA

- Class Polychaeta
 - Sub-class Errantia
 - Sub-class Sedentaria
- Class Archiannelida
- Class Oligochaeta
 - Order Plesiopora Plesiotheca
 - Order Plesiopora Prosotheca
 - Order Prosopora
 - Order Opisthopora
- Class Hirudinea
 - Order Acanthobdellida
 - Order Rhynchobdellida
 - Order Gnathobdellida
 - Order Pharyngobdellida

PHYLUM ECHIURIDA

PHYLUM SIPUNCULIDA

PHYLUM ARTHROPODA

- SUB-PHYLUM ONYCHOPHORA
- SUB-PHYLUM TARDIGRADA
- SUB-PHYLUM PENTASTOMIDA
- SUB-PHYLUM TRILOBITOMORPHA
- SUB-PHYLUM CHELICERATA

- Class Merostomata
 - Sub-class Xiphosura
 - Sub-class Eurypterida
- Class Arachnida
 - Order Scorpionida
 - Order Pseudoscorpionida
 - Order Opiliones
 - Order Acarina
 - Order Araneae
 - Order Solifugae

Classification of the Animal Kingdom

- Order Thelyphonida
- Order Schizomida
- Order Phrynichida
- Order Ricinulei
- Order Palpigradi
- SUB-PHYLUM PYCNOGONIDA
- SUB-PHYLUM MANDIBULATA
- Class Crustacea
 - Sub-class Cephalocarida
 - Sub-class Branchiopoda
 - Order Lipostraca
 - Order Anostraca
 - Order Notostraca
 - Order Diplostraca
 - Sub-order Conchostraca
 - Sub-order Cladocera
 - Sub-class Ostracoda
 - Sub-class Mystacocarida
 - Sub-class Copepoda
 - Sub-class Branchiura
 - Sub-class Cirripedia
 - Order Thoracica
 - Order Acrothoracica
 - Order Ascothoracica
 - Order Apoda
 - Order Rhizocephala
 - Sub-class Malacostraca
 - Series Leptostraca
 - Order Phyllocarida
 - Order Nebaliacea
 - Series Eumalacostraca
 - Division Syncarida*
 - Order Palaeocaridacea
 - Order Anaspidacea
 - Order Bathynellacea
 - Division Hoplocarida*
 - Order Stomatopoda
 - Division Peracarida*
 - Order Thermosbaenacea
 - Order Spelaeogriphacea
 - Order Mysidacea
 - Order Cumacea
 - Order Tanaidacea
 - Order Amphipoda
 - Order Isopoda
 - Division Eucarida*
 - Order Euphausiacea
 - Order Decapoda
 - Sub-order Natantia
 - Sub-order Reptantia
- Class Pauropoda
- Class Diplopoda

Classification of the Animal Kingdom

- Class Chilopoda
- Class Symphyla
- Class Insecta
 - Sub-class Diplura
 - Sub-class Protura
 - Sub-class Collembola
 - Sub-class Apterygota
 - Order Thysanura
 - Sub-class Pterygota
 - Division Exopterygota*
 - Order Ephemeroptera
 - Order Odonata
 - Order Plecoptera
 - Order Grylloblattoidea
 - Order Orthoptera
 - Order Phasmida
 - Order Dermaptera
 - Order Embioptera
 - Order Dictyoptera
 - Order Isoptera
 - Order Zoraptera
 - Order Psocoptera
 - Order Mallophaga
 - Order Siphunculata
 - Order Hemiptera
 - Order Thysanoptera
 - Division Endopterygota*
 - Order Neuroptera
 - Order Mecoptera
 - Order Lepidoptera
 - Order Trichoptera
 - Order Diptera
 - Order Siphonaptera
 - Order Hymenoptera
 - Order Coleoptera
 - Order Strepsiptera

PHYLUM MOLLUSCA

- Class Monoplacophora
- Class Amphineura
 - Sub-class Polyplacophora
 - Sub-class Aplacophora
- Class Scaphopoda
- Class Gastropoda
 - Sub-class Prosobranchia
 - Order Archaeogastropoda
 - Order Neritacea
 - Order Mesogastropoda
 - Order Neogastropoda
 - Sub-class Opisthobranchia
 - Order Cephalaspidea
 - Order Anaspidea

Classification of the Animal Kingdom

- Order Thecosomata
- Order Gymnosomata
- Order Notaspidea
- Order Acochlidiacea
- Order Sacoglossa
- Order Acoela
- Sub-class Pulmonata
 - Order Basommatophora
 - Order Stylommatophora
- Class Bivalvia
 - Sub-class Protobranchia
 - Sub-class Lamellibranchia
 - Order Taxodonta
 - Order Anisomyaria
 - Order Heterodonta
 - Order Schizodonta
 - Order Adapedonta
 - Order Anomalodesmata
 - Sub-class Septibranchia
- Class Cephalopoda
 - Sub-class Nautiloidea
 - Sub-class Ammonoidea
 - Sub-class Coleoidea
 - Order Belemnnoidea
 - Order Sepioidea
 - Order Teuthoidea
 - Order Octopoda
 - Order Vampyromorpha

PHYLUM PRIAPULOIDEA

PHYLUM BRYOZOA (POLYZOA, ECTOPROCTA)

- Class Stenolaemata
 - Order Cyclostomata
 - Order Trepostomata
 - Order Cryptostomata
- Class Gymnolaemata
 - Order Cheilostomata
 - Order Ctenostomata
- Class Phylactolaemata

PHYLUM PHORONIDA

PHYLUM BRACHIOPODA

- Class Inarticulata (Ecardines)
- Class Articulata (Testicardines)

PHYLUM CHAETOGNATHA

PHYLUM POGONOPHORA

PHYLUM ECHINODERMATA

- SUB-PHYLUM ECHINOZOA
 - Class Helicoplacoidea

Classification of the Animal Kingdom

Class Holothuroidea

Sub-class Dendrochirotacea

Order Dactylochirotida

Order Dendrochirotida

Sub-class Aspidochirotacea

Order Aspidochirotida

Order Elasipodida

Sub-class Apodacea

Order Molpadida

Order Apodida

Class Edrioasteroidea

Class Echinoidea

Sub-class Perischoechinoidea

Order Echinocystitoida

Order Bothriocidaroida

Order Palaechinoida

Order Cidaroida

Sub-class Euechinoidea

Super-order Diadematacea

Order Echinothurioida

Order Diademataoida

Order Pedinoida

Order Pygasteroida

Super-order Echinacea

Order Salenoida

Order Hemicidaroida

Order Phymosomatoida

Order Arbacioida

Order Temnopleuroida

Order Echinoida

Super-order Gnathostomata

Order Holoctypoida

Order Clypeasteroida

Super-order Atelostomata

Order Cassiduloida

Order Holasteroida

Order Spatangoida

Class Ophiocystioidea

SUB-PHYLUM HOMALOZOA

SUB-PHYLUM CRINOZOA *

Class Cystoidea

Class Blastoidea

Class Crinoidea

Sub-class Inadunata

Sub-class Camerata

Sub-class Flexibilia

Sub-class Articulata

SUB-PHYLUM ASTEROZOA

Class Stellerioidea

Sub-class Somasteroidea

Sub-class Asteroidea

Classification of the Animal Kingdom

- Order Platysterida
- Order Phanerozonida
- Order Spinulosida
- Order Euclasteroida
- Order Forcipulatida
- Sub-class Ophiuroidea
 - Order Stenurida
 - Order Oegophiurida
 - Order Phrynophiurida
 - Order Ophiurida

PHYLUM HEMICHORDATA†

PHYLUM CHORDATA†

* Some extinct classes not included.

† Not considered in the present volume.