

Comparative Anatomy *of the* **VERTEBRATES**

THEODORE H. EATON, Jr.



Comparative Anatomy
of the **VERTEBRATES**

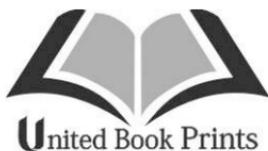
Other Related Books

- | | |
|--|------------------------------|
| A Manual of Practical Entomology, 2nd ed. | <i>Trigunayat, M.M.</i> |
| Agricultural Insect Pests and Their Control | <i>Awasthi, V.B.</i> |
| Animal Biodiversity: Patterns and Processes | <i>Ananthakrishnan, T.N.</i> |
| Beekeeping : A Compressive Guide to Bees and Beekeeping | <i>Abrol, D.P.</i> |
| Dynamics of Insect Behaviour | <i>Ananthakrishnan, T.N.</i> |
| Ecodynamics of Insect Communities | <i>Ananthakrishnan, T.N.</i> |
| Ecological Entomology: Insect Life in Odd Environments | <i>Ananthakrishnan, T.N.</i> |
| Freshwater Aquaculture, 3rd Ed. | <i>Rath, R.K.</i> |
| Freshwater Fish Pond Culture & Management | <i>Chakroff, M.</i> |
| Insect Biodiversity: Functional Dynamics and Ecological Perspectives | <i>Ananthakrishnan, T.N.</i> |
| Insect Neuroendocrines | <i>Awasthi, V.B.</i> |
| Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops | <i>Reddy, P.P.</i> |
| Integrated Pest Management | <i>Dhawan, A.K.</i> |
| Introduction to General and Applied Entomology, 3rd Edition | <i>Awasthi, V.B.</i> |
| Medical Entomology | <i>Tyagi, B.K.</i> |
| Medical Physics for Human Health Care | <i>Bhatnagar, P.K.</i> |
| Principles of Insect Behaviour, 2nd Ed. | <i>Awasthi, V.B.</i> |
| Termite Life and Termite Control in Tropical South Asia | <i>Roonwal, M.L.</i> |
| The Chemistry of Pesticides their Metabolism, Mode of Action and Uses in Crop Protection | <i>Hassall, K.A.</i> |
| The Invincible Deadly Mosquitoes | <i>Tyagi, B.K.</i> |
| Theory and Practice of Integrated Pest Management | <i>Arora, R.</i> |
| Vector-Borne Diseases: Epidemiology & Control | <i>Tyagi, B.K.</i> |
| Vertebrate Pests in Agriculture- The Indian Scenario | <i>Sridhara, S.</i> |

Comparative Anatomy
of the **VERTEBRATES**

Theodore H. Eaton, Jr.

Professor of Zoology
East Carolina College
Greenville, North Carolina



1st Reprint in India

Published by :

UNITED BOOK PRINTS
(Imprint of Scientific Publishers, INDIA)
4806/24, Ansari Road, Daryaganj,
New Delhi 110 002, INDIA
E-mail: info@scientificpub.com
Website : <http://www.scientificpub.com>

Print : 2016

All Rights Reserved. No part of this publication may be reproduced or distributed in any form or by any means without the prior written permission of the publishers.

ISBN: 978-93-83692-28-6

© *Theodore H. Eaton, Jr., 1951*

Printed in India

CONTENTS

Preface	vii
I. THE KINDS OF CHORDATES	1
The Hemichordates—The Cephalochordates—The Tunicates, or Sea Squirts—The Vertebrates	
II. DEVELOPMENT	49
General—Development of a Frog—Development of Other Chordates	
III. INTEGUMENT	68
General Nature of Integument—Color—Glands—Epidermal Structures—Special Armor—Dermal Armor—Teeth	
IV. SKELETON	96
Comparative Anatomy of the Skull	
V. SKELETON (Continued)	128
Notochord—Ribs and Sternum—Tail and Median Fins—Paired Limbs and Girdles	
VI. MUSCLES	168
What Muscles Are and What They Do—Arrangement and Divisions of the Skeletal Muscles—Comparative Anatomy of the Segmental Muscles—Comparative Anatomy of the Branchiomic Muscles	
VII. DIGESTIVE AND RESPIRATORY SYSTEMS, AND COELOM	190
Introductory—Digestive and Respiratory Organs of Protochordates—"Ammocoetes" and the Thyroid Gland—Di-	

gestive Organs of Gnathostomes—Gills in Fishes and Amphibians—Lungs and Air Bladder—Coelom and Mesenteries

VIII. CIRCULATORY SYSTEM 212

Introductory—Protochordates and Cyclostomes; The Vertebrate Plan—Heart—Arteries—Veins—Lymphatic System

IX. URINARY AND GENITAL SYSTEMS 231

Introduction—Excretory and Genital Organs of Protochordates—The Vertebrate Kidney—Reproductive Organs of Vertebrates—Secondary Sex Characters

X. SENSE ORGANS 253

Organs of Chemical Sense—Organs Detecting Pressure Change and the Movement of the Medium (Neuromast System)—Organs of Vision, the Median and Paired Eyes

XI. NERVOUS SYSTEM 269

Central Nervous System—Brain and Spinal Cord—Spinal Nerves—Cranial Nerves—Autonomic System

XII. PANORAMA 295

The Rise of Comparative Anatomy—Origin of the Vertebrates—Panorama of the Vertebrates

Bibliography 317

Index 321

PREFACE

Students should come to Comparative Anatomy prepared by one or more substantial courses in zoology, and should be in their upper college years. They can then use the course effectively to equip them for medical school, for advanced study in zoology, or for teaching. Yet Comparative Anatomy is much more than a professional training course. Its values and meanings are as rich as those of all biology. It is basic to an understanding of man's origin and relationships; it is at the heart of our knowledge of evolution. By acquainting us with the changing structure of a great host of animals, the study of Comparative Anatomy gives a framework in which we can properly place our ideas of function and of embryonic development.

In one course or one book it is possible only to introduce the student to Comparative Anatomy. But that introduction ought to contain elements of all the wider meanings of the subject, and should take recent knowledge into account particularly. Therefore I have included a chapter on embryology, and presented some of the important ideas of those who work with prehistoric animals, so far as these clarify our picture of the relationships of the vertebrate classes. It is necessary always to be aware of the "time dimension," knowing that today's life is an outgrowth of different life in past ages, and that we can trace quite accurately the steps by which man and other modern forms have become what they are.

My conviction that it helps, in studying anatomy, to know the names, appearance, and ways of life of the animals concerned has led to a fairly comprehensive first chapter on the kinds of chordates, illustrated as fully as space would permit. Since structure without function has little meaning, I try to lay emphasis on the action of organs, tissues, and mechanisms of the body. A panoramic view in the last chapter may help in coordinating parts of the whole picture.

In order that bulk may not discourage full use of this text during a

semester or a quarter, I have written concisely, but hope that it may be found full and clear enough to satisfy the more energetic student as well as the critical instructor.

It has been necessary to use, by permission, many illustrations from different sources, and I am grateful for them, but the majority are either new or redrawn by the author. The bibliography at the end lists books and papers which have been particularly useful to me, including those referred to in the text, but it is far from being either complete or well balanced. The sources cited there will lead the student to other work, however, in which he may be interested.

Here I should like to acknowledge my great obligation to Professor Charles L. Camp, of the University of California, under whom I received my first training in this field, and who gave me a vigorous enthusiasm for it; and to Professor Alfred S. Römer, of Harvard, with whom I have had most fruitful opportunities to work. Both men have read the manuscript and have given me the benefit of much critical comment. To Professor William K. Gregory, of the American Museum of Natural History, I owe my thanks for valuable suggestions and encouragement on a number of occasions. Finally I wish to inscribe this book to my mother and father, whose manifold faith and help have made the task easier.

THEODORE H. EATON, JR.

April, 1951