Vincent Bels · Ian Q. Whishaw
Editors

Feeding in Vertebrates

Evolution, Morphology, Behavior, Biomechanics

Springer

Editors
Vincent Bels
Institut Systématique Evolution Biodiversité – UMR 7205 CNRS/MNHN/Sorbonne Université/EPHE/UA
Muséum national d'Histoire naturelle
Paris, France

Ian Q. Whishaw
Canadian Center for Behavioural Neuroscience
University of Lethbridge
Lethbridge, AB, Canada

ISSN 2509-6745 ISSN 2509-6753 (electronic)
Fascinating Life Sciences
ISBN 978-3-030-13738-0 ISBN 978-3-030-13739-7 (eBook)
https://doi.org/10.1007/978-3-030-13739-7

Library of Congress Control Number: 2019932703

© Springer Nature Switzerland AG 2019
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Cover credit: Amy Knowlton, New England Aquarium, NOAA Permit Number 15415

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Foreword

This volume, assembled and edited by Bels and Whishaw, is a significant, scholarly, assessment of the current research on the evolution of vertebrate feeding systems in the context of the "form–function complex". It constitutes a major contribution that: (1) illustrates the continuing integration across biological subfields to analyze complex systems, (2) celebrates technical advances, ranging from CT scanning and PIV to sophisticated analytical and statistical methodologies, (3) incorporates phylogenetic perspectives that are essential for evolutionary research, and (4) shows how diversity of methods and organisms is essential for advancing the field of evolutionary morphology.

Anatomy/morphology reigned as the king of the biological sciences in the mid— to the late nineteenth century, where its dominance was evident in Germany in particular. But newer fields, especially physiology and development, gradually superseded the older approaches, which slowly declined in influence. By the 1960s and 1970s, the change was evident. Functional morphology—exploration of the form–function interaction—developed rapidly and the first glimmerings of biomechanics could be seen. Phylogenetics became a necessary component of comparative investigations, including a renewed focus on the relation of ontogeny to phylogeny. Hypotheses and tests were increasingly emphasized. Development, behavior, and ecology became major components of functional studies. A renaissance of morphology was evident by the early 1980s. Key to the rebirth was a new sharp focus on problems and solutions, rather than description for its own sake. Studies of trophic systems began to consider the links among perception, integration, and action. Integrative approaches, frequently including either/both ontogenetic and paleontological time dimensions, were increasingly utilized. Central to the new movements were the rebirth of venerable organizations, for example, the American Society of Zoologists, which became the Society of Integrative and Comparative Biology (SICB) near the end of the twentieth century, and the appearance of new international organizations, such as the International Congress of Vertebrate Morphology (ICVM), which reliably meets every third year at diverse sites around the world. The programs of these organizations offer amazingly rich and diverse arrays of speakers and workshops and attract large

audiences of lively young people, as well as more seasoned researchers. We live in an age of excitement and opportunity for research in the field relevant to the present volume.

We are delighted to see that this entire volume presents the advances in our science using cases to represent the diversity of research perspectives on major chordate and vertebrate lineages. By presenting these in such a broadly comparative framework, many new ideas and extensive new research into the functional biology, *sensu lato*, of feeding will be stimulated.

This volume is a thoughtful, erudite, compendium of research formulation and ideas. The authors and editors have given researchers a forward-thinking overview. We predict that it will prove to be a resource for researchers in many subfields of biology, serving to integrate and synthesize new conceptions of the evolution and function of trophic systems.

Marvalee H. Wake
David B. Wake