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978-0-521-82846-8 — Cave Biology: Life in Darkness
Aldemaro Romero
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Cave Biology

Biospeleology, the study of organisms that live in caves, has a tremendous potential to inform many aspects of modern biology; yet this area of knowledge remains largely anchored in neo-Lamarckian views of the natural world in both its approaches and jargon. Written for graduate students and academic researchers, this book provides a critical examination of current knowledge and ideas on cave biology, with emphasis on evolution, ecology, and conservation. Aldemaro Romero provides a historical analysis of ideas that have influenced biospeleology, discusses evolutionary phenomena in caves, from cave colonization to phenotypic and genotypic changes, and integrates concepts and knowledge from diverse biological viewpoints. He challenges the conventional wisdom regarding the biology of caves, and highlights urgent questions that should be addressed in order to get a better and more complete understanding of caves as ecosystems.

ALDEMARO ROMERO is Chair and Professor in the Department of Biological Sciences at Arkansas State University. He has authored more than 500 publications and his interests lie in questions in science that require an interdisciplinary approach.

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Main Photography by DANTÉ FENOLIO, Ph.D.

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University Printing House, Cambridge CB2 8BS, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314-321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi - 110025, India

103 Penang Road, #05-06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9780521828468

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First published 2009

A catalogue record for this publication is available from the British Library

Library of Congress Cataloging in Publication data
Romero Díaz, Aldemaro.
Cave biology : life in darkness / Aldemaro Romero ; main photography by Danté Fenolio.
p. cm.
Includes bibliographical references.
ISBN 978-0-521-82846-8 (hardback : alk. paper)
1. Biospeleology. I. Title.
QH89.R66 2009
578.75´84 – dc22 2009011364

ISBN 978-0-521-82846-8 Hardback
ISBN 978-0-521-53553-3 Paperback

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To my wife Ana and my daughters Jessica and Andrea, who have accompanied me on so many trips to caves around the world.

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Preface

Let me say from the outset that this book will challenge much of the conventional wisdom regarding the biology of caves. There are several reasons for that. As the reader will perceive throughout the text, biospeleology has tremendous potential to inform many aspects of modern biology, yet this area of knowledge remains largely anchored in non-neo-Darwinian views of the natural world in both its approaches and its jargon. Therefore the ideas I present here are likely to create controversy in some quarters, but that is one of the approaches of science: to generate discussions that hopefully will illuminate many aspects of the workings of nature.

The reader should not expect an attempt to condense everything known about cave biology; this book is not written with an encyclopedic mindset. What this book is all about is a critical examination of our current knowledge and ideas regarding cave biology, with an emphasis on the areas of evolution, ecology, and conservation. To that end I have selected material for the discussion that is central to those topics while taking a critical thinking approach to what is considered conventional wisdom in this subject.

The book begins with a historical analysis of ideas that have influenced biospeleology and that have been generated by researchers working in that area. Thus the aim of Chapter 1 is to give the historical and philosophical background to why I think cave biology has yet to reach its full potential.

Chapter 2 deals with the biodiversity of hypogean organisms (both cave and phreatic). This chapter has three main objectives: (1) to show the enormous diversity of cave organisms, which goes well beyond the ones that have been categorized by many authors as 'true cavernicoles'; (2) to update the reader on the progress that has been made in the study of those groups; and (3) to highlight some of the most interesting biological phenomena among the hypogean biodiversity that will be discussed later in the book.

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Chapter 3 deals with evolutionary phenomena in caves, from cave colonization to phenotypic and genotypic changes. Here, I advance ideas that, although well known in mainstream biology, have been, in my opinion, overlooked by many practitioners of biospeleology.

Chapter 4 has to do with the ecology of caves. My approach to this topic also aims to integrate concepts and knowledge from diverse biological viewpoints. I do not devote much space to aspects of the physical environment (autoecology) unless they are directly related to the discussion at hand. For that, the reader should refer him/herself to some of the literature cited in the book. Therefore the scope of the book is in the area of ecology defined as, "the biology of ecosystems" (*sensu* Margalef 1974). Because there have been so few modern ecological studies carried out in caves, a great deal of the discussion in this chapter is theoretical in nature while trying to point out the major areas in which we need more research.

Chapter 5 deals with conservation of the cave environment and its biota. Here, I present an integrated approach to the issue by using multiple examples from around the world with the underlying message that caves are both unique and fragile natural laboratories whose biota is being rapidly modified by humans.

I finish the book with an epilogue in which I try to point out some of the most urgent questions I think we should address in order to attain a better and more complete understanding of caves as ecosystems.

I have also added an appendix with a glossary of terms frequently employed in biospeleology. The reader not familiar with the biospeleology literature will find that cave biologists have developed a vocabulary that is hard to understand; in many ways, this reflects the typological and epistemological confusion that dominates biospeleology.

I hope you will enjoy the book. I certainly enjoyed researching for it and putting together the ideas presented here.

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Acknowledgments

I want to thank a number of people who contributed to this book. First my most sincere thanks go to Dr Danté Fenolio, who donated the majority of the pictures used in this book. Ms Amy Awai-Barber drew the figure of a wingless cave cricket from a photograph of the original bone.

Several of my colleagues at Arkansas State University (ASU) read portions of the original manuscript and made valuable suggestions: Dr David F. Gilmore (bacteria), Dr Marty Huss (fungi), Dr Staria Vanderpool (plants), Dr Alan Christian (bivalves), Dr Tanja McKay (insects), and Dr Jim Bednarz (birds). Some graduate students at ASU also made similar contributions in their areas of work: David Hayes (gastropods) and Stephen Brandebura (mammals). Dr Joy Trauth, also from ASU, read many sections of the original manuscript and made valuable contributions in terms of style and clarity.

Special thanks to Professor Michael B. Usher, of the School of Biological and Environmental Sciences at the University of Stirling, who invited me to write this book and who, with a great deal of patience as editor of this series for Cambridge University Press, guided me with ideas and encouragement in what ended up being a very long but rewarding process.

Andrej Kranjc provided unpublished information about Luka Čeč.

I also thank my students in the two biospeleology courses I taught at Arkansas State University while writing this book. My interactions with them were highly useful and they provided me with some insights regarding many of the ideas I present in this book: Jane Anfinson, Stephen Brandebura, Michel Conner, Jason Craft, Josh Engelbert, Tiffany Hollinger, Kristen Irwin, Tracy L. Klotz, Raven Lawson, Kapil Mandrekar, Charles McDowell, Jacqueline McVey, Elizabeth Medlin, Robert Neal, Melanie Partin, Melissa Patrick, John Rains, Jacob Sawyer, Corey Shaffer, Jonathon Smith, Nathan Stephens, John Stewart, Granville Vaughan, Haley Widby, and Jarret Wright.

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Thanks also to Dr Peter Luykx of the University of Miami for his thoughtful comments on my ideas about the evolution of cave fauna. Finally I want to thank my graduate adviser and colleague, Dr Steven M. Green, also of the University of Miami, for all the years of collaboration on this and other subjects.

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