国外优秀教材

Evolution

进化生物学

第二版

（影印版）

Monroe W. Strickberger

科学出版社

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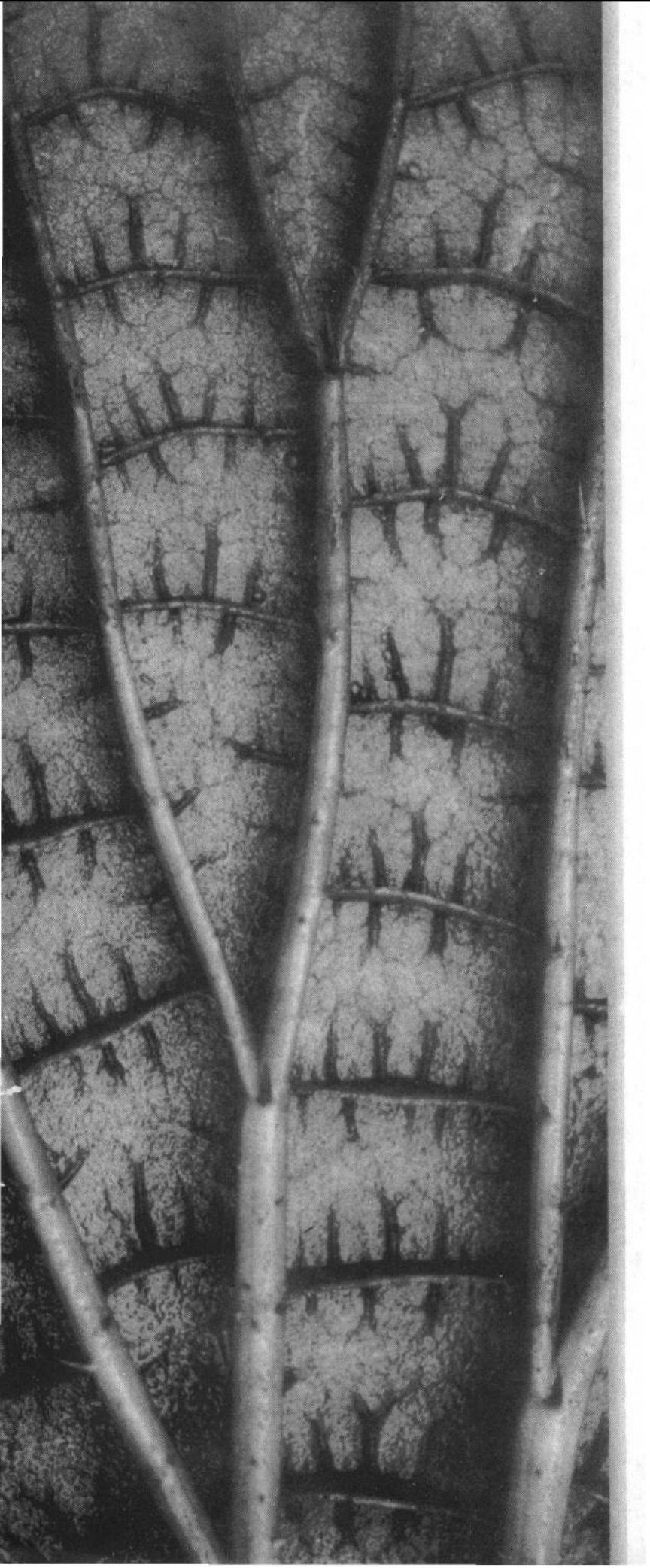

Evolution

Third Edition

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内 容 简 介

本书提供进化论的基础知识和主流思想，阐述世界和有机体因时而变的原因和机理。

进化关系和作用驱动地球上生命起源并在丰度和多样性上不断变化。本书探讨进化论思想的哲学和历史背景，宇宙和地质演变及其对生命的影响，地球上生命的起源，从遗传系统到有机体形态和功能的分子途径的发育，从微生物到动物的有机体进化史，及解释地球动态演变的大量分子和群体概念。书中精选进化学家传略和进化论专题，附章末小结、讨论题、名词解释、参考文献和作者及主题索引。在 http://www.jbpub.com/evolution 网址上，有更多的练习和相关资源。

本书有助于为生物学各专业课程奠定进化论思想基础，适用于高等院校生物学专业师生。

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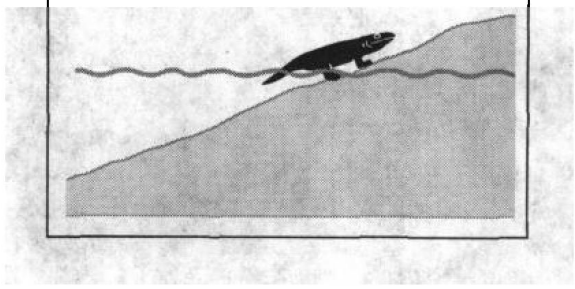
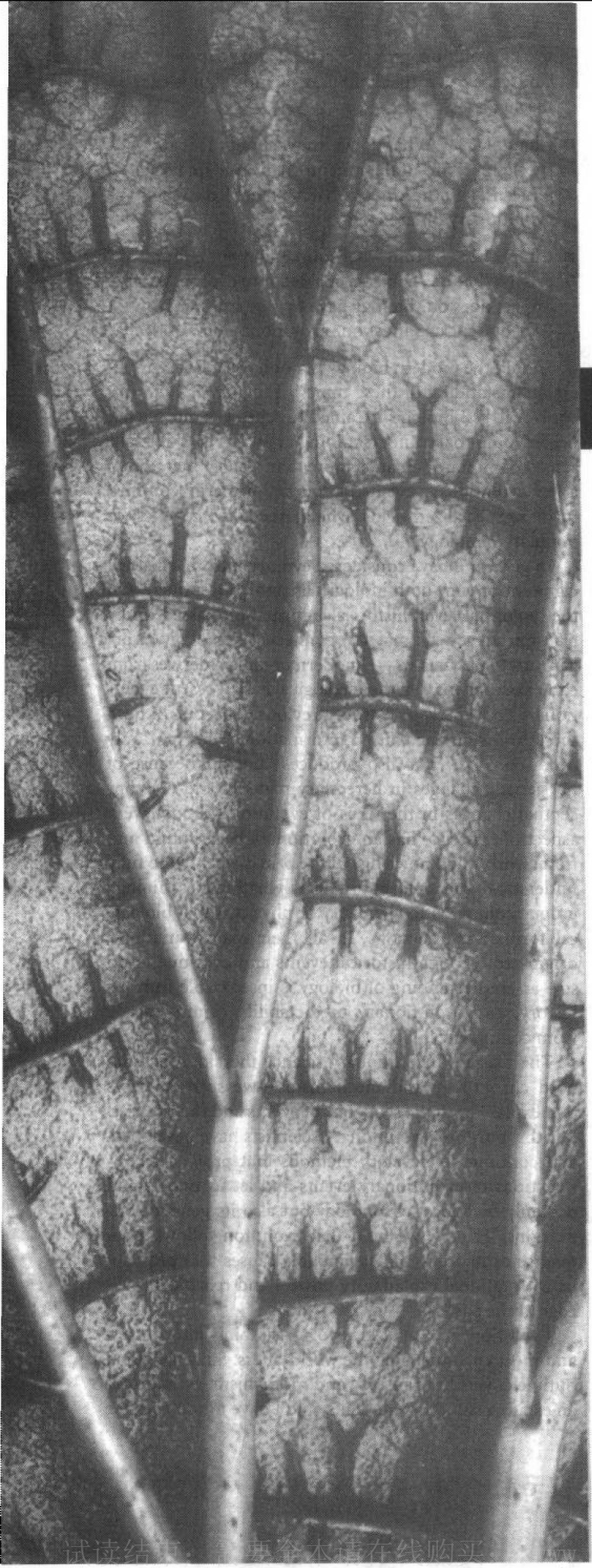
The creature pictured in the right-hand page corner throughout this book is an early tetrapod, a "four-footed" animal. Moving from water to land was a critical step in tetrapod evolution; fossil evidence of the animal itself and its footprints suggests that this may have occurred about 365 million years ago. Hypothesized advantages to moving to land include avoiding predators and exploiting terrestrial food sources, such as insects. Flip the pages of this book from front to back to watch the creature "evolve."





Preface

All biological phenomena derive from evolutionary relationships and past interactions. As the great evolutionary geneticist Theodosius Dobzhansky remarked, "Nothing in biology makes sense except in the light of evolution." Unifying all biology under an evolutionary theme is still difficult, although the explosive increase in molecular, organismic, and populational information makes the realization of this goal more possible now than ever before.

The purpose of this book is to bring together some prevailing knowledge and ideas about evolution in order to provide an informed evolutionary framework of thought for undergraduates. It is based on a course I have given for many years to biology majors who have had prior introductory biology courses. (Reviews of some basic biological and genetic concepts are nevertheless included.)

Academic biology is heavily partitioned, and biology majors take a variety of specialty courses such as development, ecology, genetics, microbiology, physiology, and they also concentrate in specific areas. Thus the evolutionary theme that runs through all of biology is often fragmented, or entirely ignored. In many courses and in many institutions, evolution is little more than a curricular afterthought, and biologists emerge from such programs with little grasp of the following basic questions and topics covered in this book:

- **Chapters 1, 2, 3:** What is the philosophical and historical background of evolutionary concepts, how did these concepts develop, and why were they so readily accepted by most scientists?
- **Chapter 4:** Why is evolution still considered controversial by so many? What basic issues cause conflict between believers in evolution and various believers in religion?
- **Chapters 5, 6:** How did cosmological and geological evolution lead to those features responsible for life on earth?
- **Chapter 7:** What chemical factors enabled life to originate on this planet, and what molecular

developments provided its substance and early direction? From what molecular sources did natural selection arise?

- **Chapter 8:** What are some proposed concepts on how protein synthesis and the genetic code evolved?
- **Chapter 9:** Whence came life's metabolic pathways, their functions, and relationships? What do we know about early cellular forms and their differences?
- **Chapter 10:** How does genetics provide the constancy and variability used in evolution?
- **Chapter 11:** How are organisms classified, and what problems are there in classifying them so they reflect evolutionary relationships?
- **Chapter 12:** What sources and techniques are used to obtain molecular information about evolution, and what phylogenies do these provide?
- **Chapter 13:** What do we know about how the major forms of plants evolved, and the evolutionary processes they employed?
- **Chapter 14:** What ideas do we have about the origin of multicellular animals and their basic features?
- **Chapter 15:** What are we discovering about organismic development, and the various paths it follows? What do we know about how and why development changes between generations over time?
- **Chapter 16:** What do we know about the evolution of invertebrate phyla? What characteristics and body forms did they assume, and how did they change?
- **Chapters 17, 18:** From what organisms may vertebrates have originated? What adaptations enabled vertebrate tetrapods to invade land, and what factors caused their various extinctions and replacements?
- **Chapter 19:** What were the early stages in mammalian evolution? How were these affected by their Mesozoic experiences, and how did geological changes affect their distributions?
- **Chapter 20:** From whence came our own species, and how does evolution explain our features, our mental attributes, and our behavior?
- **Chapters 21, 22:** What factors are involved in conserving or changing the genetic characteristics of populations, and how do these affect their evolutionary paths?
- **Chapter 23:** What contributions do topics such as neutral mutation; selectionism; the advantages of sex; coevolution; group selection; and adaptive landscapes offer that help understand evolutionary mechanisms?
- **Chapter 24:** What do we know about races and species in terms of their features, their adaptational patterns, and the kinds of barriers that led to their evolutionary differences?
- **Chapter 25:** From what sources did our culture arise? What mechanisms enabled it to evolve? What impact does our biology have on our culture? How does our culture affect our evolution?

Should the modern biology major have at least a modest understanding of these topics? The answer is an unequivocal *Yes*! Biologists trained to represent our science need evolutionary understanding at all levels! To "make sense" of biology demands more than a short mention of a few evolutionary events in courses primarily confined to more specialized fields, whether ecology, genetics, or population biology.

In general, I have considered evolution from a historical point of view both biologically and conceptually. On the biological level, historical information passed on by transmitted genetic material connects the biology of organisms to past events—a modern organism derives from earlier organisms. On the ideological level, present evolutionary concepts derive from previous concepts. In both these forms of transmitted information, "like" not only produces "like" but also produces "unlike" because of (1) genetic changes in hereditary material and (2) conceptual changes in the ideas of evolution. Almost every aspect of existence has an evolutionary background and framework, and knowledge of the past is essential to fully understand the present. In fact, what makes biology unique compared to chemistry or physics is that biological forms and functions, in all their many variations, originated through historical events and continue to do so—an understanding of biology is inseparable from its history, and evolutionary predictability cannot escape from contingency.

The realm of evolutionary science therefore includes both chronology and mechanisms—we seek concepts that explain both the sequence of events and their causes. For this purpose, evolutionary scientists have developed, and continue to develop, methods that provide reconstructions of evolutionary events and let us understand not only biological chronology but also its genetic connections. That is, we hold that evolution follows a sequence of logically understandable causes that provides us with rational explanatory powers and reliable knowledge of the past.

Evolution is a majestic story—certainly the longest and most encompassing the world offers. Since its grand outline covers both history and mechanism, evolution is an exciting subject to students, and I have found over the

years that they respond best when the textual material is generously illustrated. I have therefore provided close to 450 figures, tables, and diagrams. To further help the student master the material, the text includes boxed reviews of special topics, end-of-chapter summaries, lists of key terms, discussion questions, and a glossary. For research and reference, complete chapter bibliographies as well as separate author and subject indexes are provided. Some added points of interest, not crucial to understanding the text, are given in footnotes.

Although the order of topics offered here has worked well for my own classes, I know there are different ways to organize this material, and the chapters have generally been written to allow considerable flexibility. I have avoided an overly theoretical treatment of the subject. Nothing beyond elementary algebra is needed to understand the mathematics used.

Since evolution is the broadest of biological fields, covering the greatest range of disciplines, even the brief survey of evolution offered here has been impossible to achieve without errors and ambiguities. To the extent that this book has been spared many such failings, I owe thanks to many reviewers, who commented on one or more sections of this new edition:

Wyatt Anderson, University of Georgia, Athens

Michael Benton, University of Bristol, United Kingdom

Peter Bowler, Queen's University, Belfast, United Kingdom

Robert Foley, University of Cambridge, United Kingdom

Michael Ghiselin, California Academy of Sciences

Thomas Givnish, University of Wisconsin, Madison

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Claus Nielsen, Zoologisk Museum, Copenhagen

Karl Niklas, Cornell University

Timothy Prout, University of California-Davis

Ursula Rolfe, Children's Hospital Oakland

Trinh Thuan, University of Virginia, Charlottesville

David Wake, University of California-Berkeley

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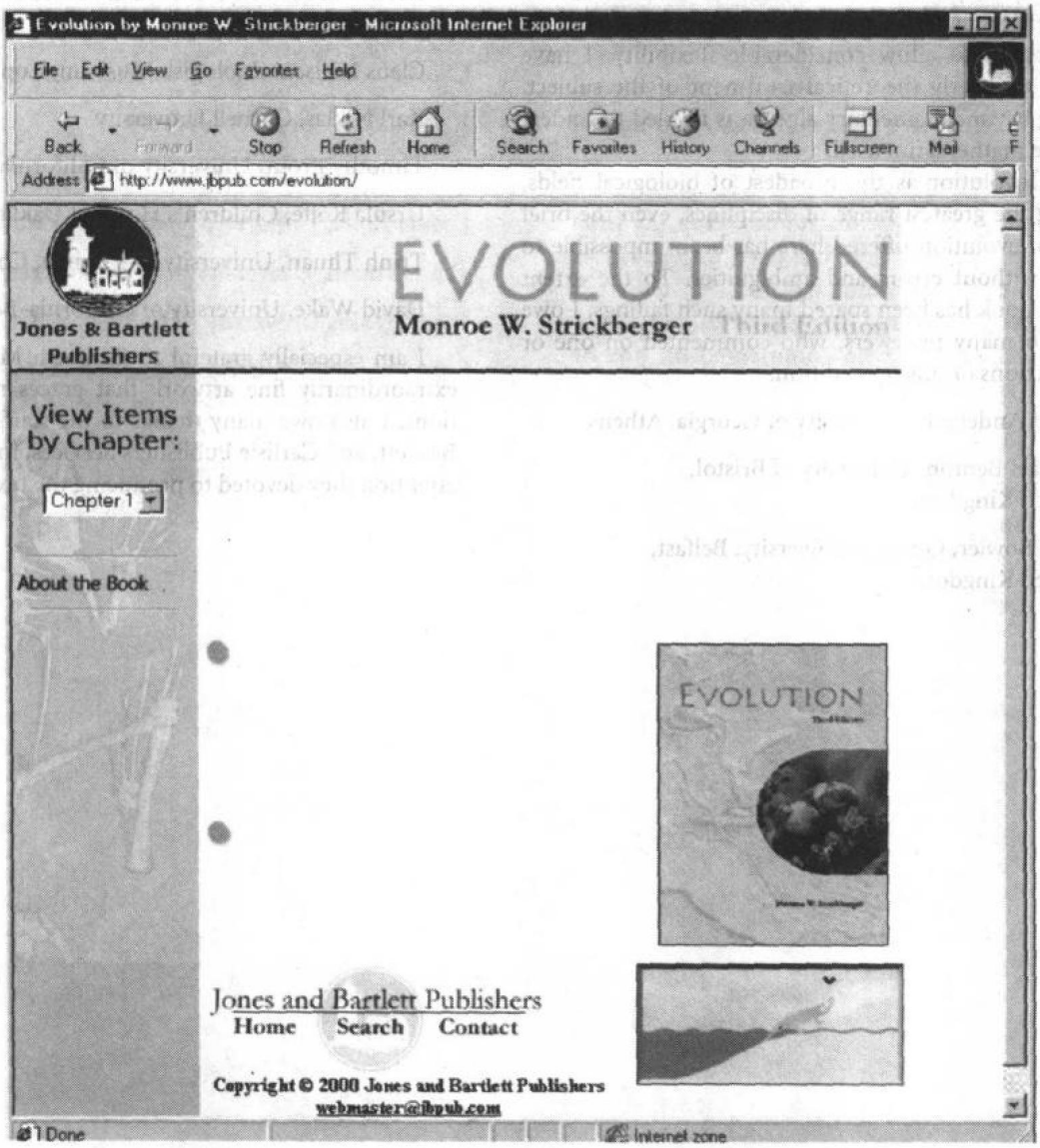
Evolution on the Web

Jones and Bartlett Publishers is pleased to present Evolution on the Web, a web site designed to accompany **Evolution, 3/e**. This site, located at www.jbpub.com/evolution, has been created to provide students with an additional learning resource and to help them take full advantage of the abundant information available on the internet. The site, prepared by Professor William A. Brindley of Utah State University, contains **Web Exercises** for each of the chapters and also **Evolution Links**, a compilation of informative links relating to the study of evolution. Evolution is a broad-ranging and interdisciplinary study. From history and theory to scientific study and fact, this web site helps students explore all aspects of evolution.



Brief Contents

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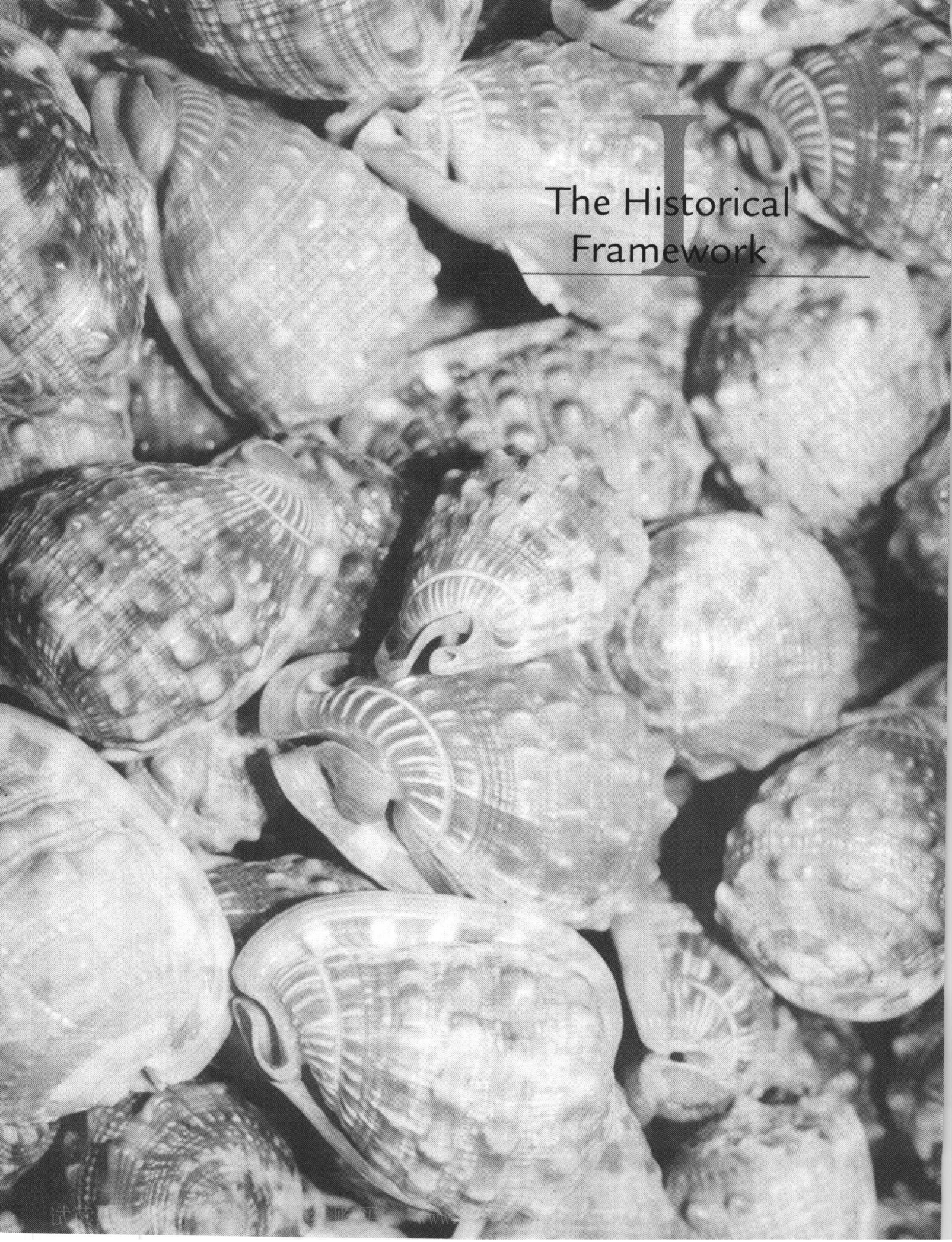

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The Historical Framework