

chapter 15 section 2 evidence of evolution

chapter 15 section 2 evidence of evolution presents a detailed exploration of the various scientific proofs that support the theory of evolution. This section highlights multiple lines of evidence that demonstrate how species have changed and diversified over time through natural processes. Key concepts such as fossil records, comparative anatomy, embryology, molecular biology, and biogeography are examined to reveal the depth of evolutionary science. Each form of evidence contributes uniquely to our understanding of life's history and the mechanisms driving evolutionary change. This article will systematically review these evidences, emphasizing their significance and interconnections in proving evolutionary theory. Understanding these foundations is crucial for comprehending how organisms are related and how evolution shapes biodiversity. The following table of contents outlines the main topics discussed in this comprehensive overview.

- Fossil Evidence of Evolution
- Comparative Anatomy and Homologous Structures
- Embryological Evidence
- Molecular Biology and Genetic Evidence
- Biogeography and Evolutionary Patterns

Fossil Evidence of Evolution

Fossils provide some of the most direct and compelling evidence for evolution. They represent the preserved remains or traces of ancient organisms that lived millions of years ago. By studying fossils, scientists can reconstruct the history of life on Earth and observe changes in species over geological time. Fossil evidence reveals transitional forms, documenting how major groups of organisms have evolved from common ancestors.

Transitional Fossils

Transitional fossils are key examples that bridge the gap between different evolutionary stages, showcasing intermediate characteristics. For instance, fossils like *Archaeopteryx* display features of both reptiles and birds, indicating the evolutionary transition between these groups. Similarly, *Tiktaalik* is a notable fossil that exhibits traits of both fish and early amphibians, providing insight into the evolution of vertebrates from aquatic to terrestrial life.

Chronological Layers and Fossil Record

The fossil record is arranged in chronological layers within sedimentary rock formations. These layers, or strata, allow scientists to date fossils and observe patterns of change through time. Older fossils are typically found in deeper layers, while more recent fossils appear closer to the surface. This stratification demonstrates a timeline of biological evolution and extinction events.

Examples of Fossil Evidence

- Trilobites - extinct marine arthropods showing early complex life forms.
- Ammonites - marine mollusks with diverse species indicative of evolutionary radiation.
- Early mammals - fossils revealing gradual development of mammalian traits.
- Hominid fossils - documenting human evolution from primate ancestors.

Comparative Anatomy and Homologous Structures

Comparative anatomy examines similarities and differences in the physical structures of different organisms. Homologous structures are anatomical features that are similar in different species because they were inherited from a common ancestor. These structures may serve different functions but share underlying similarities in form and development, providing strong evidence for evolutionary relationships.

Homologous Structures

Examples of homologous structures include the forelimbs of humans, cats, whales, and bats. Despite their different functions—grasping, walking, swimming, and flying respectively—the bone arrangements are strikingly similar. This suggests a shared evolutionary origin and subsequent adaptation to different environments and lifestyles.

Analogous Structures and Convergent Evolution

In contrast to homologous structures, analogous structures serve similar functions but evolved independently in unrelated species. These similarities arise due to convergent evolution, where different species adapt to similar environmental challenges. An example is the wings of insects and birds, which perform flight but have different anatomical origins.

Vestigial Structures

Vestigial structures are remnants of organs or features that were functional in ancestral species but have lost or reduced their original function over time. Examples include the human appendix, pelvic bones in whales, and wings in flightless birds. These structures are evidence of evolutionary history and changing selective pressures.

Embryological Evidence

Embryology studies the development of organisms from fertilization to birth or hatching. Comparative embryology reveals that embryos of different species often exhibit similar stages and structures during early development, indicating common ancestry. These developmental similarities provide important evidence supporting evolutionary theory.

Similar Early Development

Many vertebrate embryos, such as fish, reptiles, birds, and mammals, show remarkably similar features in early stages, including pharyngeal pouches and tails. These features may later develop into different adult structures, but their presence during embryonic development suggests a shared evolutionary past.

Developmental Genes and Evolution

Studies of developmental genes, such as Hox genes, demonstrate conserved genetic mechanisms that control body plan formation across diverse species. The conservation of such genes across taxa supports the idea that evolutionary changes often result from modifications in developmental processes.

Molecular Biology and Genetic Evidence

Advancements in molecular biology have provided profound evidence for evolution by comparing DNA, RNA, and protein sequences among species. Genetic similarities and differences reveal evolutionary relationships and help construct phylogenetic trees that map the divergence of species over time.

DNA Sequence Comparisons

Closely related species exhibit higher genetic similarity than more distantly related ones. For example, humans and chimpanzees share approximately 98-99% of their DNA sequences, indicating a recent common ancestor. Molecular clocks use mutation rates in DNA sequences to estimate the timing of evolutionary events.

Protein Homology

The comparison of proteins, such as cytochrome c and hemoglobin, across species also reveals evolutionary connections. Conserved protein sequences suggest functional importance and inheritance from common ancestors, while variations reflect evolutionary divergence.

Genetic Evidence for Natural Selection

Population genetics studies demonstrate how allele frequencies change in populations over time due to natural selection, genetic drift, mutation, and gene flow. These genetic changes underpin evolutionary processes and explain how species adapt to their environments.

Biogeography and Evolutionary Patterns

Biogeography studies the geographic distribution of species and ecosystems. Patterns of species distribution provide important evidence for evolution by demonstrating how geographic isolation and environmental factors drive speciation and diversification.

Island Biogeography

Islands often harbor unique species that evolved in isolation from mainland populations. The finches of the Galápagos Islands are a classic example, where different species exhibit variations in beak shape adapted to distinct ecological niches. This diversification illustrates adaptive radiation driven by geographic isolation.

Continental Drift and Species Distribution

The movement of continents over geological time has influenced the distribution and evolution of species. Similar fossils and related species found on widely separated continents provide evidence that these landmasses were once connected, allowing species to disperse and evolve in new environments.

Endemism and Evolution

Endemic species, found only in specific geographic areas, highlight evolutionary processes shaped by isolation and local conditions. The unique fauna of Australia, such as marsupials, demonstrates how long-term separation leads to distinctive evolutionary paths.

- Isolation promotes speciation through genetic divergence.

- Environmental pressures drive adaptation and natural selection.
- Geographic barriers influence gene flow and population structure.

Frequently Asked Questions

What is the main focus of Chapter 15 Section 2 on Evidence of Evolution?

Chapter 15 Section 2 focuses on various types of evidence that support the theory of evolution, including fossil records, comparative anatomy, embryology, and molecular biology.

How do fossil records provide evidence for evolution in Chapter 15 Section 2?

Fossil records show chronological changes in species over time, illustrating gradual transitions and common ancestors, which supports the concept of evolution.

What role does comparative anatomy play in providing evidence of evolution according to Chapter 15 Section 2?

Comparative anatomy examines similarities and differences in the body structures of different species, highlighting homologous structures that indicate common ancestry.

How does embryology support the theory of evolution as explained in Chapter 15 Section 2?

Embryology shows that embryos of different species display similar developmental stages, suggesting they share a common ancestor and evolutionary history.

What molecular evidence is discussed in Chapter 15 Section 2 that supports evolution?

Molecular evidence includes the comparison of DNA and protein sequences among different species, revealing genetic similarities that point to evolutionary relationships.

Why is the study of vestigial structures important in understanding evolution in Chapter 15 Section 2?

Vestigial structures are body parts that have lost their original function but remain as

evolutionary remnants, demonstrating how species have changed over time.

Additional Resources

1. Evolution: The Triumph of an Idea

This book by Carl Zimmer explores the extensive evidence supporting the theory of evolution. It delves into fossil records, comparative anatomy, and genetic data that collectively demonstrate how species have changed over time. Zimmer presents complex scientific concepts in an accessible way, making it ideal for readers interested in the proof behind evolutionary theory.

2. The Origin of Species

Written by Charles Darwin, this seminal work laid the foundation for modern evolutionary biology. Darwin meticulously presents evidence from natural selection, variation, and adaptation to argue for the descent of species with modification. The book remains a crucial reference for understanding the historical and scientific basis of evolution.

3. Why Evolution Is True

Authored by Jerry A. Coyne, this book provides a comprehensive overview of the evidence supporting evolution. Coyne discusses fossil evidence, biogeography, embryology, and molecular biology to affirm evolution as a fact. The book is praised for its clear explanations and compelling arguments that reinforce the scientific consensus on evolution.

4. Finding Darwin's God: A Scientist's Search for Common Ground Between God and Evolution

Kenneth R. Miller, a biologist and devout Christian, examines the evidence for evolution and reconciles it with religious faith. The book presents compelling scientific data, including transitional fossils and genetic evidence, to support evolutionary theory. Miller's approach encourages dialogue between science and religion, making it unique among evolution texts.

5. The Fossil Book: A Record of Prehistoric Life

This richly illustrated book offers a detailed look at the fossil evidence for evolution. It covers a wide range of prehistoric life and explains how fossils serve as a chronological record of evolutionary change. The book is excellent for readers interested in paleontology and the physical proof of evolutionary history.

6. Evolutionary Analysis

Authored by Scott Freeman and Jon C. Herron, this textbook provides in-depth coverage of evolutionary evidence and mechanisms. It integrates genetic, morphological, and fossil data to build a comprehensive understanding of how evolution operates. The book is widely used in academic settings for its rigorous approach to evolutionary biology.

7. The Greatest Show on Earth: The Evidence for Evolution

Richard Dawkins presents a compelling case for evolution using a wide range of evidence, from fossils to DNA. The book emphasizes the scientific method and how different lines of evidence converge to confirm evolutionary theory. Dawkins' engaging writing style makes the evidence accessible to both students and general readers.

8. *Life on a Young Planet: The First Three Billion Years of Evolution on Earth*

Andrew H. Knoll explores the earliest evidence of life and evolutionary processes on Earth. The book combines geological and biological data to trace the origins and early development of life. It highlights how evidence from ancient rocks and microfossils informs our understanding of evolution's early stages.

9. *Evolution: Making Sense of Life*

Carl Zimmer and Douglas Emlen collaborate to produce a modern textbook that integrates molecular biology, fossil evidence, and comparative anatomy. The book focuses on the evidence supporting evolution and how it explains the diversity of life. It is designed for students and readers seeking a thorough introduction to evolutionary evidence and concepts.

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Chapter 15, Section 2: Unassailable Evidence of Evolution - A Deep Dive

This chapter delves into the overwhelming scientific evidence supporting the theory of evolution, exploring the diverse lines of evidence that converge to paint a clear picture of life's history and the mechanisms driving its change. Understanding this evidence is crucial not only for grasping the fundamental principles of biology but also for addressing contemporary challenges such as emerging diseases, conservation efforts, and the development of new technologies.

Ebook Title: Unveiling Life's Tapestry: A Comprehensive Guide to the Evidence of Evolution

Contents Outline:

Introduction: Defining evolution and its significance.

Chapter 1: Fossil Evidence: Examining the fossil record and transitional forms.

Chapter 2: Anatomical Evidence: Homologous and analogous structures, vestigial organs.

Chapter 3: Molecular Evidence: DNA, protein sequences, and phylogenetic analysis.

Chapter 4: Biogeographical Evidence: Distribution of species across continents and islands.

Chapter 5: Direct Observation: Evolution in action: antibiotic resistance, pesticide resistance, and adaptive radiation.

Chapter 6: Developmental Biology: Embryological similarities and evolutionary developmental biology (Evo-Devo).

Conclusion: Synthesizing the evidence and addressing common misconceptions.

Detailed Breakdown of Contents:

Introduction: This section will clearly define evolution, differentiating it from other concepts like creationism and intelligent design. It will emphasize the importance of understanding evolution for various scientific disciplines and its relevance to societal issues. The introduction sets the stage for exploring the multifaceted evidence supporting this cornerstone of modern biology.

Chapter 1: Fossil Evidence: This chapter will explore the fossil record, focusing on transitional fossils that showcase the evolutionary links between different species. It will discuss dating techniques used to determine the age of fossils and address common criticisms of the fossil record's incompleteness, explaining how incomplete it is, but still sufficient to support evolutionary theory. Specific examples of transitional fossils, like *Archaeopteryx* (linking dinosaurs and birds), will be provided with recent research findings.

Chapter 2: Anatomical Evidence: This chapter will examine anatomical similarities and differences between species, focusing on homologous structures (shared ancestry) and analogous structures (convergent evolution). It will discuss vestigial organs, structures that have lost their original function but retain remnants from their evolutionary past. Examples such as the human appendix and whale pelvic bones will be thoroughly explained.

Chapter 3: Molecular Evidence: This chapter will delve into the powerful evidence provided by molecular biology. It will examine the similarities and differences in DNA and protein sequences across various species, using phylogenetic analysis to reconstruct evolutionary relationships. The importance of genetic mutations and their role in driving evolution will be highlighted, with recent research on genome sequencing and its impact on evolutionary studies.

Chapter 4: Biogeographical Evidence: This chapter will explore the geographical distribution of species, explaining how patterns of distribution provide strong support for evolution. The concept of continental drift and its influence on species distribution will be discussed. Examples of endemic species found on islands and their evolutionary relationships to mainland species will be used as case studies.

Chapter 5: Direct Observation: This chapter will focus on instances of evolution observed directly in real-time. The evolution of antibiotic resistance in bacteria and pesticide resistance in insects will be detailed with up-to-date research on the mechanisms involved. The rapid adaptive radiation of species in response to environmental changes will also be discussed, providing concrete examples of evolution in action.

Chapter 6: Developmental Biology: This chapter will explore the field of evolutionary developmental biology (Evo-Devo), focusing on how changes in developmental processes can lead to major evolutionary changes. The similarities in embryonic development across different species will be examined, highlighting conserved developmental genes and their role in shaping evolutionary pathways. Recent advances in Evo-Devo research will be discussed.

Conclusion: The conclusion will summarize the various lines of evidence presented throughout the ebook, emphasizing their convergence in supporting the theory of evolution. It will address common misconceptions and criticisms, providing scientifically accurate counterarguments. The conclusion will reinforce the overwhelming support for evolution and its continued importance in understanding the living world.

Keywords:

Evolution, natural selection, fossil evidence, anatomical evidence, molecular evidence, biogeographical evidence, direct observation, developmental biology, phylogenetic analysis, homologous structures, analogous structures, vestigial organs, antibiotic resistance, pesticide resistance, adaptive radiation, Evo-Devo, common descent, speciation, genome sequencing, transitional fossils, Darwin, Lamarck, common misconceptions.

Frequently Asked Questions (FAQs):

1. What is the difference between evolution and natural selection? Natural selection is one mechanism that drives evolution. Evolution is the overall change in the heritable characteristics of biological populations over successive generations.
2. Is evolution just a theory? In science, a theory is a well-substantiated explanation of some aspect of the natural world that can incorporate facts, laws, inferences, and tested hypotheses. Evolution is a robust theory supported by extensive evidence from multiple fields.
3. If humans evolved from apes, why are there still apes? Humans and apes share a common ancestor, not a direct ancestor-descendant relationship. Evolution is a branching process, not a linear progression.
4. How can complex structures, like the eye, evolve through natural selection? Evolution doesn't require sudden leaps of complexity. Simple light-sensitive patches can gradually evolve into complex eyes through a series of small, advantageous steps.
5. Doesn't the fossil record have gaps? The fossil record is incomplete, but this incompleteness doesn't negate the overwhelming evidence it provides. The process of fossilization is rare, and many organisms don't fossilize well.
6. How can we be sure about the dating methods used for fossils? Multiple independent dating methods (radiometric dating, etc.) corroborate each other, providing robust age estimates for fossils.
7. What is the role of mutations in evolution? Mutations are the source of new genetic variation, providing the raw material upon which natural selection acts.
8. What are some examples of evolution happening today? Antibiotic resistance in bacteria and pesticide resistance in insects are clear examples of ongoing evolution.
9. How does evolution explain the diversity of life on Earth? Evolution through various mechanisms (natural selection, genetic drift, etc.) explains the branching pattern of life, creating the vast diversity we see today.

Related Articles:

1. The Power of Phylogenetic Analysis in Evolutionary Biology: This article explores the use of phylogenetic trees in reconstructing evolutionary relationships and understanding evolutionary processes.
2. Fossil Evidence: A Window into the Past: This article provides a detailed look at various types of fossils and their significance in understanding evolutionary history.
3. Homologous Structures and the Evidence for Common Ancestry: A detailed examination of homologous structures and their implications for understanding evolutionary relationships.
4. Molecular Clocks and the Dating of Evolutionary Events: This article focuses on the use of molecular data to estimate the timing of evolutionary events.
5. Biogeography and the Distribution of Species: An in-depth look at biogeographical patterns and their implications for understanding evolutionary history.
6. The Evolution of Antibiotic Resistance: A Case Study: This article details the evolution of antibiotic resistance in bacteria, providing a contemporary example of evolution in action.
7. Evolutionary Developmental Biology (Evo-Devo): A New Frontier: This article explores the field of Evo-Devo and its implications for understanding evolutionary change.
8. Addressing Common Misconceptions about Evolution: This article directly addresses common criticisms and misunderstandings regarding the theory of evolution.
9. The Significance of Vestigial Organs in Evolutionary Studies: This article focuses on the importance of vestigial organs as evidence for evolutionary history.

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chapter 15 section 2 evidence of evolution: The Galapagos Islands Charles Darwin, 1996

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book includes sample activities for teaching about evolution and the nature of science. For example, the book includes activities that investigate fossil footprints and population growth that teachers of science can use to introduce principles of evolution. Background information, materials, and step-by-step presentations are provided for each activity. In addition, this volume: Presents the evidence for evolution, including how evolution can be observed today. Explains the nature of science through a variety of examples. Describes how science differs from other human endeavors and why evolution is one of the best avenues for helping students understand this distinction. Answers frequently asked questions about evolution. Teaching About Evolution and the Nature of Science builds on the 1996 National Science Education Standards released by the National Research Council—and offers detailed guidance on how to evaluate and choose instructional materials that support the standards. Comprehensive and practical, this book brings one of today's educational challenges into focus in a balanced and reasoned discussion. It will be of special interest to teachers of science, school administrators, and interested members of the community.

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Donald R. Prothero's *Evolution* is an entertaining and rigorous history of the transitional forms and series found in the fossil record. Its engaging narrative of scientific discovery and well-grounded analysis has led to the book's widespread adoption in courses that teach the nature and value of fossil evidence for evolution. *Evolution* tackles systematics and cladistics, rock dating, neo-Darwinism, and macroevolution. It includes extensive coverage of the primordial soup, invertebrate transitions, the development of the backbone, the reign of the dinosaurs, and the transformation from early hominid to modern human. The book also details the many alleged "missing links" in the fossil record, including some of the most recent discoveries that flesh out the fossil timeline and the evolutionary process. In this second edition, Prothero describes new transitional fossils from various periods, vividly depicting such bizarre creatures as the *Odontochelys*, or the "turtle on the half shell"; fossil snakes with legs; and the "Frogamander," a new example of amphibian transition. Prothero's discussion of intelligent design arguments includes more historical examples and careful examination of the "experiments" and observations that are exploited by creationists seeking to undermine sound science education. With new perspectives, Prothero reframes creationism as a case study in denialism and pseudoscience rather than a field with its own intellectual dynamism. The first edition was hailed as an exemplary exploration of the fossil evidence for evolution, and this second edition will be welcome in the libraries of scholars, teachers, and general readers who stand up for sound science in this post-truth era.

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How should the concept of evidence be understood? And how does the concept of evidence apply to the controversy about creationism as well as to work in evolutionary biology about natural selection and common ancestry? In this rich and wide-ranging book, Elliott Sober investigates general questions about probability and evidence and shows how the answers he develops to those questions apply to the specifics of evolutionary biology. Drawing on a set of fascinating examples, he analyzes whether claims about intelligent design are untestable; whether they are discredited by the fact that many adaptations are imperfect; how evidence bears on whether present species trace back to common ancestors; how hypotheses about natural selection can be tested, and many other issues. His book will interest all readers who want to understand philosophical questions about evidence and evolution, as they arise both in Darwin's work and in contemporary biological research.

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Everything you were taught about evolution is wrong.

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According to polling data, most Americans doubt that evolution is a real phenomenon. And it's no wonder that so many are skeptical: many of today's biology courses and textbooks dwell on the mechanisms of evolution—natural selection, genetic drift, and gene flow—but say little about the evidence that evolution happens at all. How do we know that species change? Has there really been enough time for evolution to operate? With *The Evidence for Evolution*, Alan R. Rogers provides an elegant, straightforward text that details the evidence for evolution. Rogers covers different levels of evolution, from within-species changes, which are much less challenging to see and believe, to much larger ones, say, from fish to amphibian, or from land mammal to whale. For each case, he supplies numerous lines of evidence to illustrate the changes, including fossils, DNA,

and radioactive isotopes. His comprehensive treatment stresses recent advances in knowledge but also recounts the give and take between skeptical scientists who first asked “how can we be sure” and then marshaled scientific evidence to attain certainty. The Evidence for Evolution is a valuable addition to the literature on evolution and will be essential to introductory courses in the life sciences.

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insect fossils from the Mid Mesozoic period (165 to 125 Ma) that were discovered in Northeastern China. It covers not only their taxonomy and morphology, but also their potential implications on natural sciences, such as phylogeny, function, interaction, evolution, and ecology. It covers fossil sites; paleogeology; co-existing animals and plants in well-balanced eco-systems; insects in the spotlight; morphological evolution and functional development; and interactions of insects with co-existing plants, vertebrates, and other insects. The book also includes many elegant and beautiful photographs, line drawings, and 3-D reconstructions of fossilized and extant insects. Rhythms of Insect Evolution: Evidence from the Jurassic and Cretaceous in Northern China features chapter coverage of such insects as the: Ephemeroptera; Odonata; Blattaria; Isoptera; Orthoptera; Notoptera; Dermaptera; Chresmodidae; Phasmatodea; Plecoptera; Psocoptera; Homoptera; Heteroptera; Megaloptera; Raphidioptera; Neuroptera; Coleoptera; Hymenoptera Diptera; Mecoptera; Siphonaptera; Trichoptera and Lepidoptera. Combines academic natural science, popular science, and artistic presentation to illustrate rhythms of evolution for fossil insects from the Mid Mesozoic of Northern China Documents morphology, taxonomy, phylogeny, and evolutionary changes of 23 orders of insects from the Middle Jurassic and Early Cretaceous faunas in Northern China Presents interactions of insects with plants, vertebrates, and other insects based on well-preserved fossil evidence Uses photos of extant insects and plants, fossil and amber specimens, line drawings, and 3-D computer-generated reconstruction artworks to give readers clear and enjoyable impressions of the scientific findings Introduces insect-related stories from western and Chinese culture in text or sidebars to give global readers broader exposures Rhythms of Insect Evolution: Evidence from the Jurassic and Cretaceous in Northern China will appeal to entomologists, evolutionists, paleontologists, paleoecologists, and natural scientists.

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evolution of new species? How does coevolution among species continually reshape the web of life? And, more generally, how are our views of adaptive evolution changing? *Relentless Evolution* draws on studies of all the major forms of life—from microbes that evolve in microcosms within a few weeks to plants and animals that sometimes evolve in detectable ways within a few decades. It shows evolution not as a slow and stately process, but rather as a continual and sometimes frenetic process that favors yet more evolutionary change.

chapter 15 section 2 evidence of evolution: *Adaptation and Natural Selection* George Christopher Williams, 2018-10-30 Biological evolution is a fact—but the many conflicting theories of evolution remain controversial even today. When *Adaptation and Natural Selection* was first published in 1966, it struck a powerful blow against those who argued for the concept of group selection—the idea that evolution acts to select entire species rather than individuals. Williams's famous work in favor of simple Darwinism over group selection has become a classic of science literature, valued for its thorough and convincing argument and its relevance to many fields outside of biology. Now with a new foreword by Richard Dawkins, *Adaptation and Natural Selection* is an essential text for understanding the nature of scientific debate.

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chapter 15 section 2 evidence of evolution: *Water Code* Texas, 1972

chapter 15 section 2 evidence of evolution: *Evolution* Jonathan Bard, 2021-12-31 Evolution is the single unifying principle of biology and core to everything in the life sciences. More than a century of work by scientists from across the biological spectrum has produced a detailed history of life across the phyla and explained the mechanisms by which new species form. This textbook covers both this history and the mechanisms of speciation; it also aims to provide students with the background needed to read the research literature on evolution. Students will therefore learn about cladistics, molecular phylogenies, the molecular-genetical basis of evolutionary change including the important role of protein networks, symbionts and holobionts, together with the core principles of developmental biology. The book also includes introductory appendices that provide background knowledge on, for example, the diversity of life today, fossils, the geology of Earth and the history of evolutionary thought. Key Features Summarizes the origins of life and the evolution of the eukaryotic cell and of Urbilateria, the last common ancestor of invertebrates and vertebrates. Reviews the history of life across the phyla based on the fossil record and computational phylogenetics. Explains evo-devo and the generation of anatomical novelties. Illustrates the roles of small populations, genetic drift, mutation and selection in speciation. Documents human evolution using the fossil record and evidence of dispersal across the world leading to the emergence of modern humans.

chapter 15 section 2 evidence of evolution: Did Darwin Write the Origin Backwards?

Elliott Sober, 2011-03-31 Is it accurate to label Darwin's theory the theory of evolution by natural selection, given that the concept of common ancestry is at least as central to Darwin's theory? Did Darwin reject the idea that group selection causes characteristics to evolve that are good for the group though bad for the individual? How does Darwin's discussion of God in *The Origin of Species* square with the common view that he is the champion of methodological naturalism? These are just some of the intriguing questions raised in this volume of interconnected philosophical essays on Darwin. The author's approach is informed by modern issues in evolutionary biology, but is sensitive to the ways in which Darwin's outlook differed from that of many biologists today. The main topics that are the focus of the book—common ancestry, group selection, sex ratio, and naturalism—have rarely been discussed in their connection with Darwin in such penetrating detail. Author Professor Sober is the 2008 winner of the Prometheus Prize. This biennial award, established in 2006 through the American Philosophical Association, is designed to honor a distinguished philosopher in recognition of his or her lifetime contribution to expanding the frontiers of research in philosophy and science. This insightful collection of essays will be of interest to philosophers, biologists, and laypersons seeking a deeper understanding of one of the most influential scientific theories ever propounded.

chapter 15 section 2 evidence of evolution: Principles of Evolution: Systems, Species, and the History of Life Jonathan Bard, 2016-09-12 *Principles of Evolution* considers evolution in the context of systems biology, a contemporary approach for handling biological complexity. Evolution needs this systems perspective for three reasons. First, most activity in living organisms is driven by complex networks of proteins and this has direct implications, particularly for understanding evo-devo and for seeing how variation is initiated. Second, it provides the natural language for discussing phylogenetic trees. Third, evolutionary change involves events at levels ranging from the genome to the ecosystem and systems biology provides a context for integrating material of this complexity. Understanding evolution means, on the one hand, describing the history of life and, on the other, making sense of the principles that drove that history. The solution adopted here is to make the science of evolution the primary focus of the book and place the various parts of the history of life in the context of the research that unpicks it. This means that the history is widely distributed across the text. This concise textbook assumes that the reader has a fair amount of biological knowledge and gives equal weight to all the major themes of evolution: the fossil record, phylogenetics, evo-devo, and speciation. *Principles of Evolution* will therefore be an interesting and thought-provoking read for honors-level undergraduates, and graduates working in the biological sciences.

chapter 15 section 2 evidence of evolution: *The Selfish Gene* Richard Dawkins, 1989 Science need not be dull and bogged down by jargon, as Richard Dawkins proves in this entertaining look at evolution. The themes he takes up are the concepts of altruistic and selfish behaviour; the genetical definition of selfish interest; the evolution of aggressive behaviour; kinship theory; sex ratio theory; reciprocal altruism; deceit; and the natural selection of sex differences. 'Should be read, can be read by almost anyone. It describes with great skill a new face of the theory of evolution.' W.D. Hamilton, *Science*

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record, the earth, and the universe. The book also features the stories of animal species strange and familiar, including humans—and our ties to some of our closest relatives and more distant cousins. Prothero's wide-ranging tales showcase awe-inspiring and bizarre aspects of nature and the powerful insights they give us into the way that life works. Brisk and entertaining while firmly grounded in fundamental science, *The Story of Evolution in 25 Discoveries* is a captivating read for anyone curious about the evidence for evolution and what it means for humanity.

chapter 15 section 2 evidence of evolution: 99% Ape Jonathan W. Silvertown, 2009 Darwin was mocked for suggesting that humans have apes for ancestors, but every scientific advance in the study of life in the last 150 years has confirmed the reality of evolution. In *99% Ape: How Evolution Adds Up* leading experts explain this fundamental yet often complex subject and guide the general reader through the latest evidence.--Back cover.

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chapter 15 section 2 evidence of evolution: Plant Evolution Karl J. Niklas, 2016-08-12

Although plants comprise more than 90% of all visible life, and land plants and algae collectively make up the most morphologically, physiologically, and ecologically diverse group of organisms on earth, books on evolution instead tend to focus on animals. This organismal bias has led to an incomplete and often erroneous understanding of evolutionary theory. Because plants grow and reproduce differently than animals, they have evolved differently, and generally accepted evolutionary views—as, for example, the standard models of speciation—often fail to hold when applied to them. Tapping such wide-ranging topics as genetics, gene regulatory networks, phenotype mapping, and multicellularity, as well as paleobotany, Karl J. Niklas's *Plant Evolution* offers fresh insight into these differences. Following up on his landmark book *The Evolutionary Biology of Plants*—in which he drew on cutting-edge computer simulations that used plants as models to illuminate key evolutionary theories—Niklas incorporates data from more than a decade of new research in the flourishing field of molecular biology, conveying not only why the study of evolution is so important, but also why the study of plants is essential to our understanding of evolutionary processes. Niklas shows us that investigating the intricacies of plant development, the diversification of early vascular land plants, and larger patterns in plant evolution is not just a botanical pursuit: it is vital to our comprehension of the history of all life on this green planet.

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chapter 15 section 2 evidence of evolution: *The Global Findex Database 2017* Asli Demirguc-Kunt, Leora Klapper, Dorothe Singer, Saniya Ansar, 2018-04-19 In 2011 the World

Bank—with funding from the Bill and Melinda Gates Foundation—launched the Global Findex database, the world's most comprehensive data set on how adults save, borrow, make payments, and manage risk. Drawing on survey data collected in collaboration with Gallup, Inc., the Global Findex database covers more than 140 economies around the world. The initial survey round was followed by a second one in 2014 and by a third in 2017. Compiled using nationally representative surveys of more than 150,000 adults age 15 and above in over 140 economies, The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution includes updated indicators on access to and use of formal and informal financial services. It has additional data on the use of financial technology (or fintech), including the use of mobile phones and the Internet to conduct financial transactions. The data reveal opportunities to expand access to financial services among people who do not have an account—the unbanked—as well as to promote greater use of digital financial services among those who do have an account. The Global Findex database has become a mainstay of global efforts to promote financial inclusion. In addition to being widely cited by scholars and development practitioners, Global Findex data are used to track progress toward the World Bank goal of Universal Financial Access by 2020 and the United Nations Sustainable Development Goals. The database, the full text of the report, and the underlying country-level data for all figures—along with the questionnaire, the survey methodology, and other relevant materials—are available at www.worldbank.org/globalfindex.

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