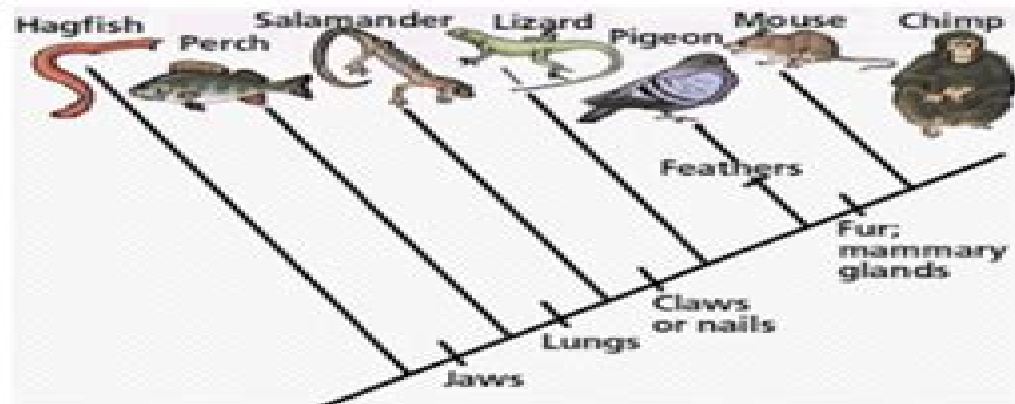


## Make a Cladogram Lab

**Background:** Cladistics is the study of evolutionary classification. A cladogram, or a branching tree, shows evolutionary relationships among organisms. Comparative morphology investigates characteristics for homology and analogy to determine which organisms share a recent common ancestor. A cladogram will begin by grouping organisms based on a characteristic displayed by ALL the members of the group. Subsequently, the larger group will contain increasingly smaller groups that share the traits of the groups before them. However, they also exhibit distinct changes as the new species evolve. Further, molecular evidence from genes which rarely mutate can provide molecular clocks that tell us how long ago organisms diverged, unlocking the secrets of organisms that may have similar convergent morphology but do not share a recent common ancestor.

### Pre-Lab Questions:



**Fig. 1 Sample Cladogram**

1. Which organisms in the cladogram in figure 1 have fur and mammary glands?
2. Which organisms in the cladogram in figure 1 have jaws?
3. Based on the cladogram in figure 1, which shared a common ancestor most recently – a mouse and a lizard or a mouse and a perch?
4. Which two organisms would you expect to have a closer matching DNA sequence for a gene that doesn't matter in terms of natural selection – Hagfish and Pigeon or Hagfish and Salamander?
5. Using the species listed in Tables 1 and 2, hypothesize and list the species in order of evolutionary relationships beginning with Amoeba.

# Cladogram Example Problems And Answers

**Henry M. Hoenigswald, Linda F. Wiener**



## Cladogram Example Problems And Answers:

**Organizing the Green World: A Conceptual History of Botanical Classification** Tod F. Stuessy, 2025-09-02 This book focuses on plant systematics and evolution with special interest on the history and philosophy of botanical classification Tracing the history of how humans have dealt with ordering the plant world is very much a glimpse of how human culture and science have progressed over the past 2000 years The objective in this book is to present ideas on plant classification beginning with classical Greek and Roman scholars through the Middle Ages into the Renaissance and finally to the modern 21st century Significant quantitative methods in classification have originated within the past 70 years which have never before been integrated with previous historical perspectives Most textbooks of systematic botany contain an historical introduction or perhaps a chapter on the history of classification but this book presents much greater detail on the classifications themselves and the cultural dimensions of the different time periods Biographical detail is also provided to give a better appreciation of the individual botanists who have contributed new ideas in the search for maximally predictive systems

Cladistic Biogeography Christopher J. Humphries, Lynne R. Parenti, 1999-04-15 The distribution and classification of life on earth has long been of interest to biological theorists as well as to travellers and explorers Cladistic biogeography is the study of the historical and evolutionary relationships between species based on their particular distribution patterns across the earth Analysis of the distributions of species in different areas of the world can tell us how those species and areas are related what regions or larger groups of areas exist and what their origins might be The first edition of Cladistic Biogeography was published in 1986 It was a concise exposition of the history methods applications of and prospects for cladistic biogeography Well reviewed and widely used in teaching Cladistic Biogeography is still in demand despite having been out of print for some time This new edition draws on a wide range of examples both plant and animal from marine terrestrial and freshwater habitats It has been updated throughout with the chapters being rewritten and expanded to incorporate the latest research findings and theoretical and methodological advances in this dynamic field

Biological Metaphor and Cladistic Classification Henry M. Hoenigswald, Linda F. Wiener, 2016-11-11 The dynamic aspect of biological systems the birth growth and death of individual organisms the evolution of one form into another over time has formed the basis for metaphors used in many fields for both artistic and heuristic purposes Cladistic classification uses a tree whose branch points are based on the possession of derived or relatively recent characteristics rather than primitive ones

**New Zealand Journal of Zoology** , 1989

*Springer Handbook of Bio-/Neuro-Informatics* Nikola Kasabov, 2013-11-30 The Springer Handbook of Bio Neuro Informatics is the first published book in one volume that explains together the basics and the state of the art of two major science disciplines in their interaction and mutual relationship namely information sciences bioinformatics and neuroinformatics Bioinformatics is the area of science which is concerned with the information processes in biology and the development and applications of methods tools and systems for storing and processing of biological

information thus facilitating new knowledge discovery Neuroinformatics is the area of science which is concerned with the information processes in biology and the development and applications of methods tools and systems for storing and processing of biological information thus facilitating new knowledge discovery The text contains 62 chapters organized in 12 parts 6 of them covering topics from information science and bioinformatics and 6 cover topics from information science and neuroinformatics Each chapter consists of three main sections introduction to the subject area presentation of methods and advanced and future developments The Springer Handbook of Bio Neuroinformatics can be used as both a textbook and as a reference for postgraduate study and advanced research in these areas The target audience includes students scientists and practitioners from the areas of information biological and neurosciences With Forewords by Shun ichi Amari of the Brain Science Institute RIKEN Saitama and Karlheinz Meier of the University of Heidelberg Kirchhoff Institute of Physics and Co Director of the Human Brain Project     Plant Taxonomy Tod F. Stuessy, 2009-01-01 The field of plant taxonomy has transformed rapidly over the past fifteen years especially with regard to improvements in cladistic analysis and the use of new molecular data The second edition of this popular resource reflects these far reaching and dramatic developments with more than 3 000 new references and many new figures Synthesizing current research and trends Plant Taxonomy now provides the most up to date overview in relation to monographic biodiversity and evolutionary studies and continues to be an essential resource for students and scholars This text is divided into two parts Part 1 explains the principles of taxonomy including the importance of systematics characters concepts of categories and different approaches to biological classification Part 2 outlines the different types of data used in plant taxonomic studies with suggestions on their efficacy and modes of presentation and evaluation This section also lists the equipment and financial resources required for gathering each type of data References throughout the book illuminate the historical development of taxonomic terminology and philosophy while citations offer further study Plant Taxonomy is also a personal story of what it means to be a practicing taxonomist and to view these activities within a meaningful conceptual framework Tod F Stuessy recalls the progression of his own work and shares his belief that the most creative taxonomy is done by those who have a strong conceptual grasp of their own research     *Cladistics* Ian J. Kitching, 1998 Cladistics aims to reconstruct genealogies based on common ancestry thus revealing the phylogenetic relationships between taxa Its applications vary from linguistic analysis to the study of conservation and biodiversity and it has become a method of choice for comparative studies in all fields of biology This new edition of Cladistics first published in 1992 reflects the many changes and developments which have taken place in the field over the last five years while retaining the clarity and readability that made the first edition so successful For all students interested in the systematic relationships among organisms this book provides a state of the art account of the techniques and methods of modern cladistics and of how to put them into practice     **Evolution ,     Parsimony, Phylogeny, and Genomics** Victor A. Albert, 2005-03-24 Table of contents     **REAL Volume 8 (1991/1992) , 1992     Geometric**

Morphometrics for Biologists Miriam Zelditch, Donald Swiderski, H. David Sheets, William L. Fink, 2004-07-21 Geometric Morphometrics for Biologists is an introductory textbook for a course on geometric morphometrics written for graduate students and upper division undergraduates covering both theory of shape analysis and methods of multivariate analysis It is designed for students with minimal math background taking them from the process of data collection through basic and more advanced statistical analyses Many examples are given beginning with simple although realistic case studies through examples of complex analyses requiring several different kinds of methods The book also includes URL s for free software and step by step instructions for using the software Accessible student tested introduction to sophisticated methods of biological shape analysis Detailed instructions for conducting analyses with freely available easy to use software Numerous illustrations including graphical presentations of important theoretical concepts and demonstrations of alternative approaches to presenting results Many realistic examples both simple and complex from on going research Comprehensive glossary of technical terms      Proceedings of the Linnean Society of New South Wales Linnean Society of New South Wales, 1996      **Plant Systematics** Michael G. Simpson, 2011-08-09 Plant Systematics is a comprehensive and beautifully illustrated text covering the most up to date and essential paradigms concepts and terms required for a basic understanding of plant systematics This book contains numerous cladograms that illustrate the evolutionary relationships of major plant groups with an emphasis on the adaptive significance of major evolutionary novelties It provides descriptions and classifications of major groups of angiosperms including over 90 flowering plant families a comprehensive glossary of plant morphological terms as well as appendices on botanical illustration and plant descriptions Pedagogy includes review questions exercises and references that complement each chapter This text is ideal for graduate and undergraduate students in botany plant taxonomy plant systematics plant pathology ecology as well as faculty and researchers in any of the plant sciences The Henry Allan Gleason Award of The New York Botanical Garden awarded for Outstanding recent publication in the field of plant taxonomy plant ecology or plant geography 2006 Contains numerous cladograms that illustrate the evolutionary relationships of major plant groups with an emphasis on the adaptive significance of major evolutionary novelties Provides descriptions and classifications of major groups of angiosperms including over 90 flowering plant families Includes a comprehensive glossary of plant morphological terms as well as appendices on botanical illustration and plant description      Paleontological Data Analysis Øyvind Hammer, David A. T. Harper, 2024-03-04 PALEONTOLOGICAL DATA ANALYSIS An up to date edition of the indispensable guide to analysing paleontological data Paleontology has developed in recent decades into an increasingly data driven discipline which brings to bear a huge variety of statistical tools Applying statistical methods to paleontological data requires a discipline specific understanding of which methods and parameters are the most appropriate ones and how to account for statistical bias inherent in the fossil record By guiding the reader to these and other fundamental questions in the statistical analysis of fossilized specimens Paleontological Data Analysis has become

the standard text for anyone with an interest in quantitative analysis of the fossil record Now fully updated to reflect the latest statistical methods and disciplinary advances it is an essential tool for practitioners and students alike Readers of the second edition of *Paleontological Data Analysis* readers will also find New sections on machine learning Bayesian inference phylogenetic comparative methods analysis of CT data and much more New use cases and examples using PAST R and Python software packages Full color illustrations throughout *Paleontological Data Analysis* is ideal for paleontologists evolutionary biologists taxonomists and students in any of these fields

**Style and Function** Teresa D. Hurt, Gordon Rakita, 2000-10-30 The topics of style and function within evolutionary archaeology have been the subject of great debate in the field of archaeology in general over the past two decades Evolutionary archaeologists have a unique perspective on these concepts one that has sometimes been misunderstood by archaeologists working within other theoretical perspectives The dichotomy between style and function was first formulated in the late 1970s by Robert Dunnell and remains axiomatic within the theoretical perspective of evolutionary archaeology The original definitions of style and function were grounded in biological evolutionary concepts regarding neutral variation versus variation that is subject to natural selection Several chapters expand upon these concepts and explore how Darwinian evolutionary theory may be used to understand the archaeological record Other chapters demonstrate this application through empirical case studies Dunnell provides a foreword introducing and re examining his original thesis This volume is the only text devoted to the topic of style and function within the literature of evolutionary archaeology It provides not only theoretical discussions and augmentation but also significant historical background regarding the development of the style function distinction within archaeology Moreover it presents several case studies that provide examples of how evolutionary style and function may be applied to the prehistoric record

**Historical Biogeography** Jorge CRISCI, Liliana Katinas, Paula Posadas, Jorge Víctor Crisci, 2009-06-30 Though biogeography may be simply defined the study of the geographic distributions of organisms the subject itself is extraordinarily complex involving a range of scientific disciplines and a bewildering diversity of approaches For convenience biogeographers have recognized two research traditions ecological biogeography and historical biogeography This book makes sense of the profound revolution that historical biogeography has undergone in the last two decades and of the resulting confusion over its foundations basic concepts methods and relationships to other disciplines of comparative biology Using case studies the authors explain and illustrate the fundamentals and the most frequently used methods of this discipline They show the reader how to tell when a historical biogeographic approach is called for how to decide what kind of data to collect how to choose the best method for the problem at hand how to perform the necessary calculations how to choose and apply a computer program and how to interpret results

*Encyclopedia of Biodiversity*, 2013-02-05 The 7 volume *Encyclopedia of Biodiversity* Second Edition maintains the reputation of the highly regarded original presenting the most current information available in this globally crucial area of research and study It brings together the dimensions of

biodiversity and examines both the services it provides and the measures to protect it Major themes of the work include the evolution of biodiversity systems for classifying and defining biodiversity ecological patterns and theories of biodiversity and an assessment of contemporary patterns and trends in biodiversity The science of biodiversity has become the science of our future It is an interdisciplinary field spanning areas of both physical and life sciences Our awareness of the loss of biodiversity has brought a long overdue appreciation of the magnitude of this loss and a determination to develop the tools to protect our future Second edition includes over 100 new articles and 226 updated articles covering this multidisciplinary field from evolution to habits to economics in 7 volumes The editors of this edition are all well respected instantly recognizable academics operating at the top of their respective fields in biodiversity research readers can be assured that they are reading material that has been meticulously checked and reviewed by experts Approximately 1 800 figures and 350 tables complement the text and more than 3 000 glossary entries explain key terms

*Cladistics* David M. Williams, Malte C. Ebach, 2020-08-06 This new edition of a foundational text presents a contemporary review of cladistics as applied to biological classification It provides a comprehensive account of the past fifty years of discussion on the relationship between classification phylogeny and evolution It covers cladistics in the era of molecular data detailing new advances and ideas that have emerged over the last twenty five years Written in an accessible style by internationally renowned authors in the field readers are straightforwardly guided through fundamental principles and terminology Simple worked examples and easy to understand diagrams also help readers navigate complex problems that have perplexed scientists for centuries This practical guide is an essential addition for advanced undergraduates postgraduates and researchers in taxonomy systematics comparative biology evolutionary biology and molecular biology

Phylogeny Reconstruction in Paleontology Robert M. Schoch, 1986

**Morphological Evolution, Adaptations, Homoplasies, Constraints, and Evolutionary Trends** Rui Diogo, 2004-01-11 The major aim of this work is to help clarify the interrelationships of catfishes with major implications on the study of the general evolution of these fishes A great part of this work therefore deals with a cladistic analysis of catfish higher level phylogeny based on extensive morphological data in which are included some terminal taxa not

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