

# Biochemical Evidence For Evolution Lab 12

## Answer Key

Biochemical Evidence For Evolution Lab 12 Answer Key Biochemical Evidence for Evolution Lab 12 Answer Key This lab explores the molecular basis of evolution by analyzing biochemical data focusing on the similarities and differences in protein sequences and DNA sequences across various species. By comparing these sequences, students will gain a deeper understanding of how evolutionary relationships can be traced through molecular evidence. Evolution Biochemistry Protein Sequencing DNA Sequencing Phylogeny Molecular Clock Homology Analogy Phylogenetic Tree This lab delves into the field of molecular evolution where the focus is on analyzing the similarities and differences in the biochemical components of organisms to understand their evolutionary history. Students will analyze protein and DNA sequences using bioinformatics tools and techniques to construct phylogenetic trees. The lab explores key concepts like homology, analogy, and the molecular clock, highlighting how these concepts can be used to trace evolutionary relationships and estimate divergence times between species.

**Lab Procedure**

**Sample Objective**

To use biochemical data to analyze evolutionary relationships between different species.

**Materials**

Computer with internet access Bioinformatics software eg BLAST Clustal Omega Protein and DNA sequence data for various species provided Spreadsheet software eg Microsoft Excel Google Sheets

**Procedure**

- 1 Obtain and analyze protein sequences Download the provided protein sequence data for multiple species Use BLAST Basic Local Alignment Search Tool to compare the sequences and identify homologous proteins Align the protein sequences using Clustal Omega to identify regions of similarity and difference
- 2 Construct a phylogenetic tree Use the aligned protein sequences to generate a phylogenetic tree using a suitable tree building algorithm eg neighborjoining maximum likelihood Interpret the resulting tree identifying evolutionary relationships between the species based on the protein sequence data
- 3 Analyze DNA sequences Repeat steps 1 and 2 using provided DNA sequences Compare the resulting phylogenetic trees from protein and DNA sequence analysis
- 4 Discuss the results Analyze the similarities and differences between the phylogenetic trees generated from protein and DNA data Relate the results to the concepts of homology, analogy, and the molecular clock Evaluate the strength of the evidence provided by molecular data for the evolutionary relationships between the species

**Answer Key**

**Part 1 Protein Sequence Analysis**

- 1 Homology Explain the concept of homology distinguishing between homologous and analogous structures Identify homologous proteins in the provided sequences justifying your answer
- 2 Alignment Explain how protein sequence alignment reveals evolutionary relationships Analyze the aligned protein sequences highlighting regions of similarity and difference
- 3 Phylogenetic Tree Explain the principles behind phylogenetic tree construction Interpret the generated phylogenetic tree identifying the evolutionary relationships between the species based on protein sequences
- 4 Molecular Clock Explain the concept of the molecular clock noting its limitations Use the protein sequence data to estimate the divergence times between the species

**Part 2 DNA Sequence Analysis**

- 1 Homology and Alignment Repeat the homology and alignment analysis for DNA sequences emphasizing the 3 differences and similarities between protein and DNA

sequence analysis 2 Phylogenetic Tree Construct a phylogenetic tree based on the DNA sequence data Compare the phylogenetic tree constructed from DNA sequences with the one constructed from protein sequences Discuss any similarities and differences 3 Discussion Discuss the strengths and weaknesses of using protein and DNA sequences as molecular markers for phylogenetic analysis Discuss the implications of your results for the evolutionary relationships between the species Conclusion The biochemical evidence for evolution presented in this lab demonstrates the powerful tool that molecular data provides for understanding evolutionary relationships By analyzing the similarities and differences in protein and DNA sequences we can reconstruct evolutionary history trace the divergence of species and estimate divergence times The molecular clock while not without limitations offers a valuable method for quantifying evolutionary change This lab highlights the fundamental role of biochemistry in evolutionary biology showcasing how molecular data can be used to support and refine our understanding of the interconnectedness of life on Earth Thoughtprovoking Conclusion This lab is a stepping stone towards understanding the immense complexity of lifes history It demonstrates how molecular data like a genetic fingerprint can be used to unravel the relationships between species revealing the intricate tapestry of evolutionary history However this is just the beginning The field of molecular evolution is constantly evolving with new technologies and approaches pushing the boundaries of our understanding Future research will continue to refine our knowledge of evolutionary relationships ultimately leading to a deeper appreciation for the diversity and interconnectedness of life on our planet FAQs 1 Why are protein sequences used to study evolution Proteins are the workhorses of cells performing a vast array of functions Their sequences reflect evolutionary change as mutations accumulate over time 2 How does the molecular clock work The molecular clock assumes that mutations accumulate at a relatively constant rate By 4 comparing sequences and counting mutations we can estimate the time since two species diverged 3 Can we really trust the molecular clock The molecular clock has limitations Mutation rates can vary between genes and lineages and environmental factors can influence evolution Its best used in conjunction with other data 4 What are the limitations of using molecular data for phylogenetic analysis Molecular data can be influenced by factors like horizontal gene transfer recombination and convergent evolution This can create inconsistencies and challenges in reconstructing evolutionary relationships 5 How does this lab relate to current research in evolutionary biology This lab provides a foundation for understanding current research in evolutionary biology where molecular data is increasingly used to explore complex evolutionary questions like the origins of life the evolution of human populations and the impact of climate change on biodiversity This lab is a valuable introduction to the exciting and everevolving field of molecular evolution It emphasizes the power of molecular data to shed light on the past and shape our understanding of the future of life on Earth

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