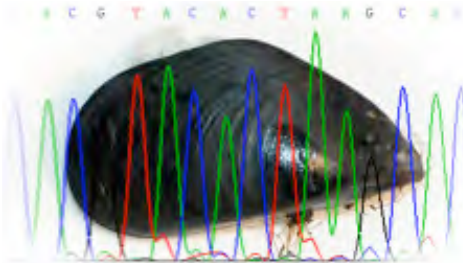


Marine Biotechnology and Bioinformatics



A program of ITEST (Information Technology Experiences for Students and Teachers) funded by the National Science Foundation



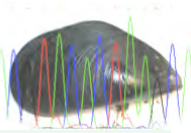
Relationships Revealed: Creating Cladograms

Biology

Grade 9-12

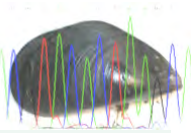
Becky Corrigan

Lincoln Park HS, Chicago, IL



Background Context

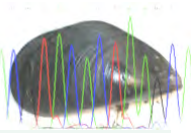
- ▶ This lesson is intended for biology students, grade 9-12
- ▶ The idea behind this lesson is to expand a lesson already in use
- ▶ Students will use fossil evidence and bioinformatics to create cladograms
- ▶ The importance of DNA technology will be highlighted



Instructional Goals

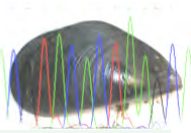
Students will be able to:

- ▶ use bioinformatics
- ▶ analyze cladograms
- ▶ discuss why technology is important to our current knowledge of biological mechanisms.
- ▶ Understand that nothing in science is written in stone, how it's ok to question current theories, and how advances in technology shape our ideas in science.



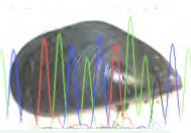
Illinois Standards

- ▶ **12.A.4c** Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry.
- ▶ **13.A.4c** Describe how scientific knowledge, explanations and technological designs may change with new information over time
- ▶ **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies.
- ▶ **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs.



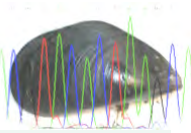
Instructional Objectives

- ▶ Students will compare relationships based on skeletal analysis with relationships generated by DNA analysis
- ▶ Students will learn how to use computer bioinformatics related to DNA analysis



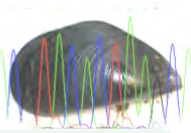
Materials and Resources

- ▶ Skeletons of various vertebrates (bat, cat, pigeon, rat, frog, perch, human).
- ▶ Computers with access to the internet
- ▶ Entrez database (
<http://www.ncbi.nlm.nih.gov/sites/gquery>)
- ▶ CLUSTALW (<http://align.genome.jp/>)



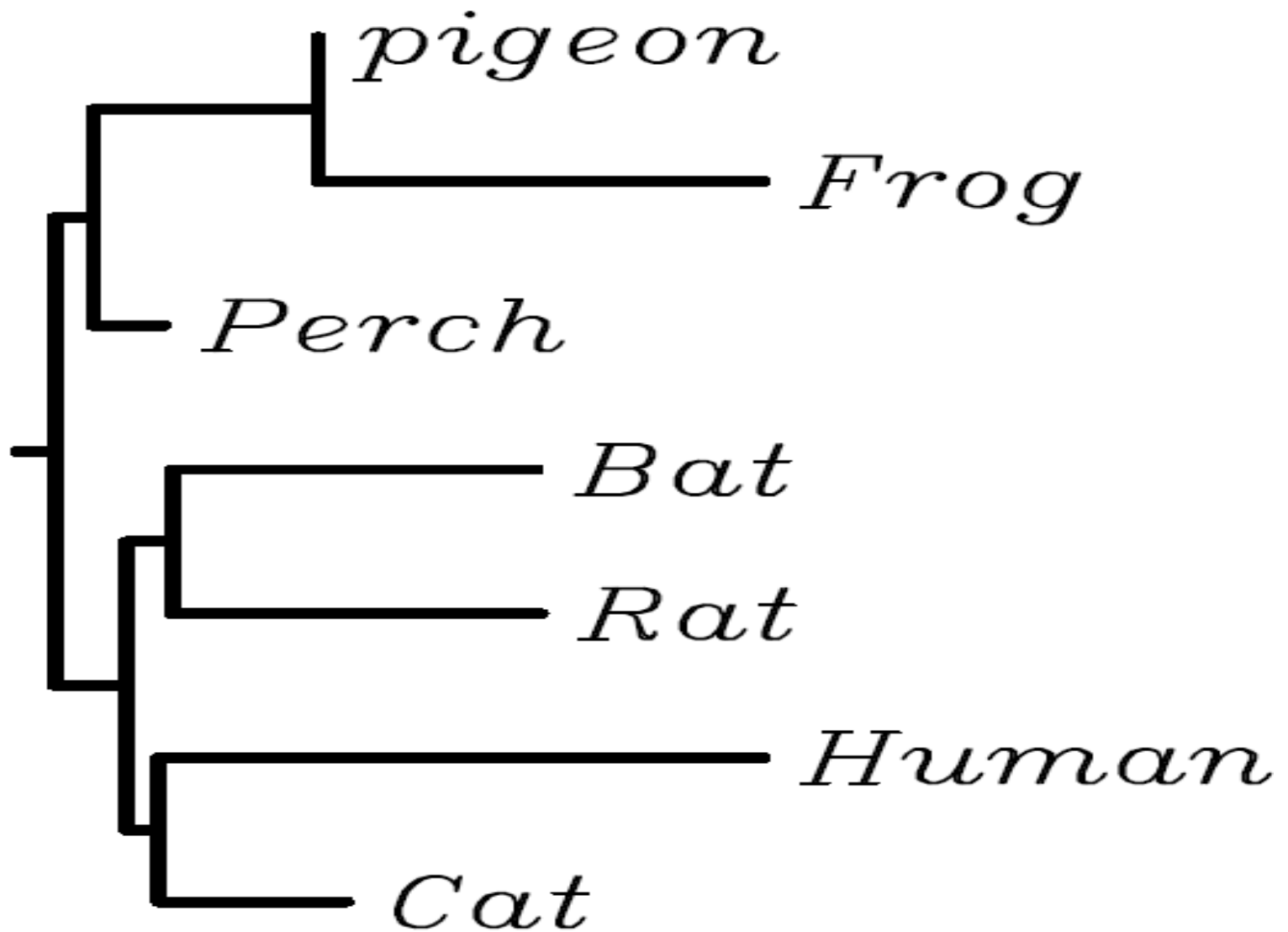
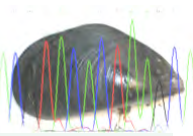
Instructional Strategies

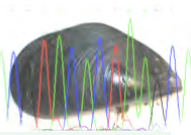
- 1) Students look at skeletons of selected species.
- 2) Students draw the forearms; color-coding the bones for comparison.
- 3) Students use these drawings to create a cladogram.
- 4) Class discussion on these initial cladograms.



Instructional Strategies

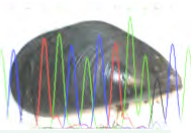
- 5) Lesson on Entrez and CLUSTALW
- 6) Students search Entrez for Cytochrome c amino acid sequence and use CLUSTALW to create a tree.
- 7) Students compare what they have found with CLUSTALW to the initial cladogram they created.
- 8) Teacher leads a class discussion.





Assessment

- ▶ Conclusion essay with prompt.
- ▶ Whales & hippos activity for homework will demonstrate that students can apply bioinformatics to other situations.



Contact

- ▶ For more information about this lesson, contact:
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