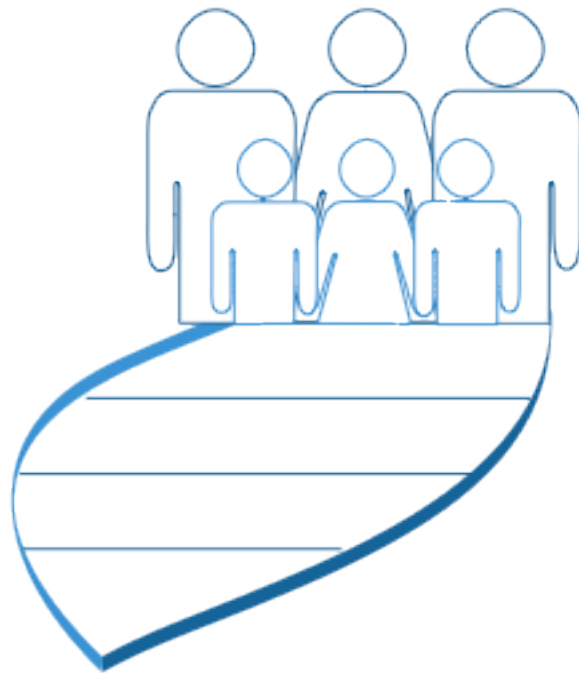


Life Sciences/HHMI
OutReach
PROGRAM



BIOGEOGRAPHY and So Much More

A WebQuest

9th grade Freshman Science, 10th grade Biology

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Image courtesy of BIODIDAC




Introduction

website

<http://biodidac.bio.uottawa.ca/>

At a time when people did not venture too far from home, locating and describing all species on Earth was considered a manageable task. If it looked like a duck and quacked like a duck...it probably was a duck! However, after the early 1400s when explorers began embarking on globe-spanning explorations (think Columbus, Magellan, and da Gama) this attitude changed. Once explorers began to bring back tens-of-thousands of new plants and animals from around the globe, the work of describing, naming, and categorizing new discoveries became practically overwhelming. Remember, this was before Antoni van Leeuwenhoek (1632-1723) invented the first optical microscope. It was before Carolus Linnaeus (1707-1778) devised a binomial system for naming living things. It would be at least another 500 years before DNA testing became common. As technology became available, it became easier for scientists to detect and describe relationships between species. However, these early naturalists persevered and attempted to group all organisms into different categories based only upon their physical characteristics (comparative morphology).

A strange thing happened when these naturalists started studying and classifying the new organisms. They made a two puzzling observations. One was that **certain species separated by great distances resembled one another**. The second was that **many plants and animals were unique to remote, isolated areas**. Instead of generating answers, their observations led to more questions such as:

-  *When species share similarities, what does it say about their ancestors?*
-  *How did so many species get from one center of creation to isolated islands and remote locations?*
-  *What factors go into deciding if a species can survive and live to pass along its genes?*

We, in turn, ask: How can we use the answers to these questions to help explain our world and all that is in it?

The Task

This activity will ask you to visit a variety of websites and:

- familiarize yourself with the concepts of *Biogeography* and *Natural Selection*
- recognize that *Evolution* is not something that happened in the past but is a process that continues to operate
- see that the evolutionary processes give us the *Diversity of Life* we enjoy on this planet
- apply what you have learned to explain life in your own section of the world today

Have a notebook handy to write down theories, names of people and places, diagrams, concepts you do not understand, and important vocabulary you know and do not know.



Now would be a good time to brush-up on your understanding of the principles of classification, taxonomy, and the diversity of life. Please do so by visiting http://anthro.palomar.edu/animal/animal_1.htm for a brief tutorial.

Take notes and pay close attention to bolded or underlined words.

1. If you were one of the early taxonomists, what information would be important to you when trying to categorize a new species?

2. Thinking like an early taxonomist, if you found two different species that closely resembled each other, what would you say about them?

3. During the 19th century, Charles Darwin, proposed a theory to explain changes found in nature. Explain in your own words his theory.

4. Thinking like an evolutionist, if you found two different species that closely resembled each other, what would you say about them?

5. What do you think it means when two organisms share a common ancestor?

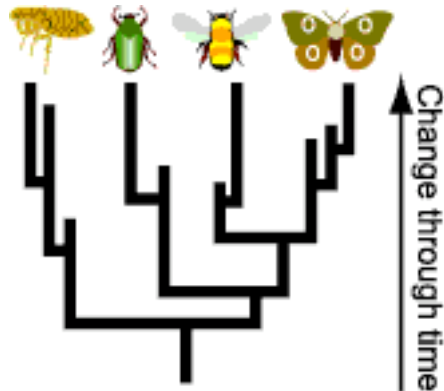
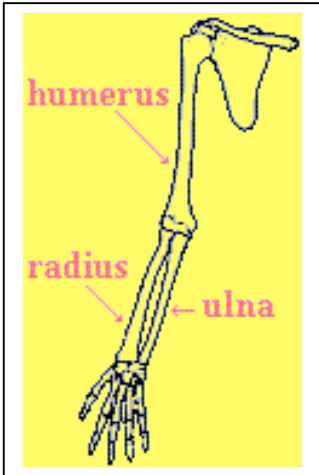


Image courtesy of the UC Museum of Paleontology Understanding Evolution <http://evolution.berkeley.edu>

Let's continue your investigation of the principles of classification. Please visit http://anthro.palomar.edu/animal/animal_2.htm.

Take notes and pay close attention to bolded or underlined words.



6. If you noticed, early taxonomist used physical characteristics to distinguish different species. Biologists begin their classifications by looking at anatomical features. What do you think is the difference between physical characteristics and anatomical features?

Image courtesy of the UC Museum of Paleontology Understanding Evolution <http://evolution.berkeley.edu>

7. Suppose a scientist finds two different organisms that have similar anatomical features. The features are used for similar purposes. The features also work in similar manners. What might that scientist say about these organisms ancestry? Explain.

8. Using the information provided on the website, define the following anatomical features as homologous, parallel, convergent, or analogous. Do these features indicate that the organisms share a common ancestor or not? Explain your reasoning for both examples in question 9.

Wings of a bird – Wings of a butterfly

Circle the correct description of the similarity

Homology **Parallelism** **Convergence** **Analogy**

A bird and a butterfly share / **do not share** a common ancestor.

Human arm – Forelimb of a bear – Wing of a bird

Circle the correct description of the similarity

Homology **Parallelism** **Convergence** **Analogy**

A human, a bear, and a bird **share / do not share** a common ancestor.

9. Please explain your choices from above. If you are still unsure visit http://evolution.berkeley.edu/evolibrary/article/0_0_0/similarity_ms_01 for another explanation.

Wings of the bird and butterfly

Human arm, forelimb of bear, and wing of a bird

10. Comparisons of DNA sequences is becoming more commonly used to differentiate species. What does it mean if two organisms share many of the same sequences?

Now it is time for you to be the naturalist. Please visit <http://www.natureportfolio.com/birds/ratites.php> and study the photos of the ostrich, emu, and rhea. Pay attention to scientific names and the native region of species which are listed in the table. You can click on the thumbnail image to preview a larger picture.

11. Based upon physical characteristics, would you say that the ostrich, emu, and rhea share a common ancestor? Please explain your answer.

12. Is there any other information you might like before making your decision?

Please visit <http://animaldiversity.ummz.umich.edu/site/search?SearchableText=ostrich&Search.x=0&Search.y=0> to see if current science agrees with your conclusion. Fill in the table below.

	<i>Emu</i>	<i>Ostrich</i>	<i>Rhea</i>
Kingdom			
Phylum			
Class			
Order			

13. Do these three birds share a common ancestor? What does that imply about their geographical origin?

14. We know that the emu, ostrich, and rhea are native to certain regions of the world. Please return to <http://www.natureportfolio.com/birds/ratites.php> and list their regions below.

Emu _____ Ostrich _____ Rhea _____

Place an E for emu, an O for ostrich, and an R for rhea to mark their native regions on the map below.

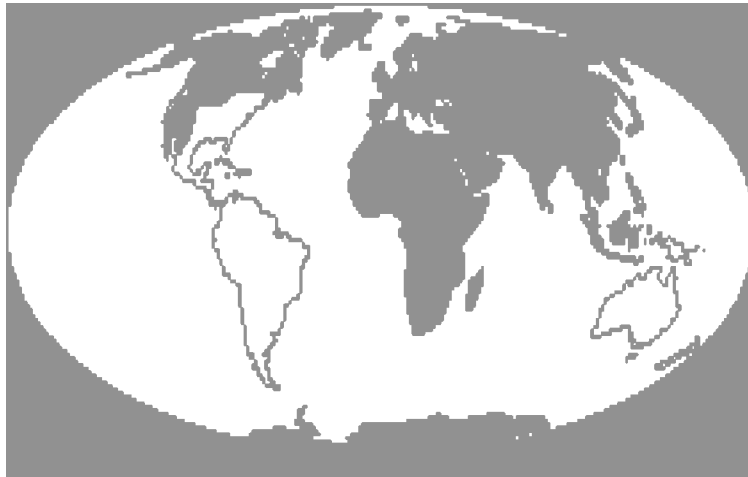


Image courtesy of the UC Museum of Paleontology Understanding Evolution <http://evolution.berkeley.edu>

15. If in fact scientists are correct that the emu, ostrich, and rhea all share a common ancestor, how do you explain the fact that they are geographically separate?

If you are starting to think that the continents may not have always been where they are today, you are on the right track. Please visit

http://evolution.berkeley.edu/evolibrary/article/0_0/history_16

Make a list of the new vocabulary and people's names as you read.

You may also want to visit

http://evolution.berkeley.edu/evolibrary/article/0_0_0/lines_11

16. The name Biogeography is an appropriate name for this area of science. Explain in your own words what biogeography means.

17. According to Wallace and his colleagues, what would explain the evolution of similar but geographically separate species such as the emu, ostrich, and rhea?

How long ago did all this happen? To find out, please review a Geologic Time Table at http://www.uaf.edu/geology/reference/geo_time.html

18. According to the timetable, when did life first appear on Earth? _____

19. How many years later did the first birds appear? _____

20. How many years was it from the first signs of life until humans inhabited Earth? _____

21. How many years passed between the extinction of the dinosaurs and the appearance of the first humans? _____

Scientists paid close attention to fossils while looking for evidence that life evolved. Darwin observed the fossils of the giant glyptodonts that had become extinct. Please visit <http://www.bbc.co.uk/nature/wildfacts/factfiles/3005.shtml> to see an image of the glyptodont, and then visit <http://animaldiversity.ummz.umich.edu/site/accounts/information/Xenarthra.html> to discover who their present-day ancestors are.

22. Of all the animals on Earth, only living armadillos are like glyptodonts. And armadillos live in the same places where glyptodonts lived. If the two animals had been created at the same time, lived in the same place, and were so much alike, why is only one still alive?

In the late 18th century, Thomas Malthus, an economist, wrote an essay called *An Essay on the Principles of Population as it affects the Future Improvement of Society*. He claimed that humans run out of food, living space, and resources because they reproduce too much. Darwin was greatly influenced by this point of view. He adopted Malthus's ideas and applied them to the natural world. When Darwin thought about his own observations of living things it dawned on him that variations in traits may affect an individual organism's ability to find resources, survive, and reproduce in a particular environment. You can read more about Malthus and how his work influenced scientific thought at http://evolution.berkeley.edu/evolibrary/article/0/history_07.

23. How did you answer the question found below the World Population Growth graph? Explain your answer. _____

24. What do famine, disease, and being unable to reproduce have to do with evolution? (** Think about this – if the objective in life is to survive and pass along your traits – what happens to you and your family tree when there is a famine or when you become very very sick?)

25. We've been talking about and using the term "traits". In your own words, what is a trait? Please provide an example. _____

Certain traits give a population the advantage to survive and reproduce. Selection for this trait is one of the basic mechanisms of evolution. Please visit [http://evolution.berkeley.edu/evolibrary/article/ 0/evo 25](http://evolution.berkeley.edu/evolibrary/article/0/evo_25) to find out more.

26. In your own words, explain why the population could eventually become all brown beetles. _____

27. What if the green beetles in the case presented was a completely separate species that birds also enjoyed eating. What would ultimately happen to the species? _____

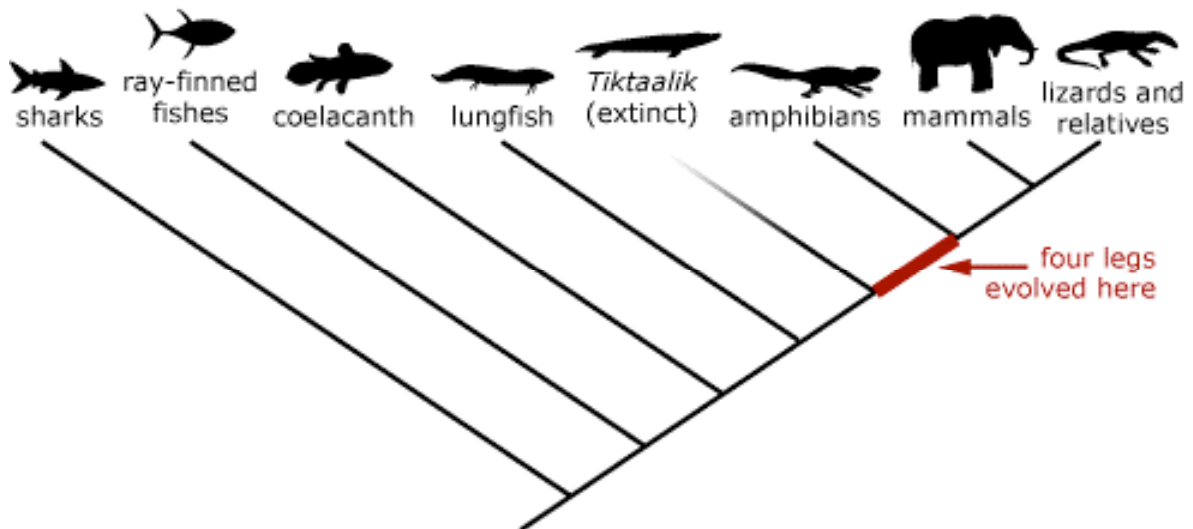


Image courtesy of the UC Museum of Paleontology Understanding Evolution <http://evolution.berkeley.edu>

Think about the species that live around you. From an evolutionary point of view, choose four species that you feel are the most successful? Be specific in your choices. In this case measure success in terms of numbers, geographic distribution, and how long they have existed on Earth. Write on each of these attributes and explain your reasoning. Include examples of their closest relatives. You will want to revisit some of the websites and/or visit new ones to get more information to support your choices. Cite your sources.

The Process

Students can use this Webquest:

- to review the evolution of the Earth and living things
 - to introduce the concept of biogeography
 - as a starting point for applying evolutionary processes to evaluate and explain their surroundings
 - to familiarize themselves with evolutionary websites
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Evaluation

Evaluation throughout the Quest is at the discretion of the teacher. The last question where students are asked to choose four species they feel are the most successful can be completed individually or with a partner(s). The teacher can structure the assignment in whatever form best fits the intentions of the lesson.

Conclusion

The objective of this activity is to demonstrate to students that:

- the evolutionary process has taken a vast amount of time
- the Earth as well as living things undergoes evolution
- theories concerning evolution have changed as more facts and new scientific techniques have been introduced
- the evolutionary processes can be used to explain the world around us

Credits & References

The Paleontology Portal retrieved July 12,2006 from <http://www.paleoportal.org>.

Palomar Community College retrieved July 12, 2006 from <http://anthro.palomar.edu>

Starr, C. & Taggart, R. (2006). *Evolution of Life*. The Thompson Corporation. Belmont, CA.

Understanding Evolution retrieved July 12, 2006 from http://evolution.berkeley.edu/evolibrary/article/0_0_0/similarity_ms_01

University of Michigan Museum of Zoology: Animal Diversity retrieved July 12, 2006 from <http://animaldiversity.ummz.umich.edu/site/search?SearchableText=ostrich&Search.x=0&Search.y=0>