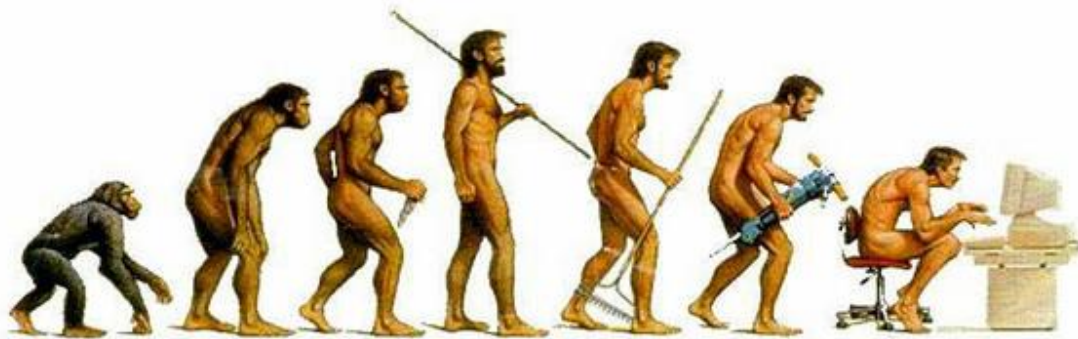


# Evolution

(Any change in the characteristics of a population over many generations.)

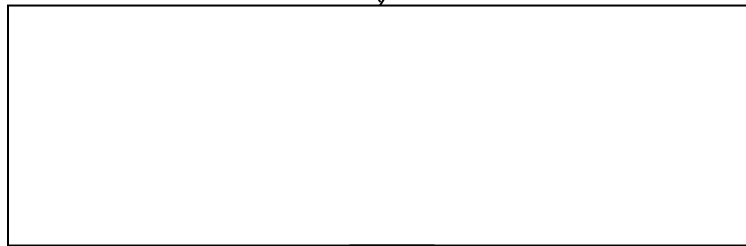
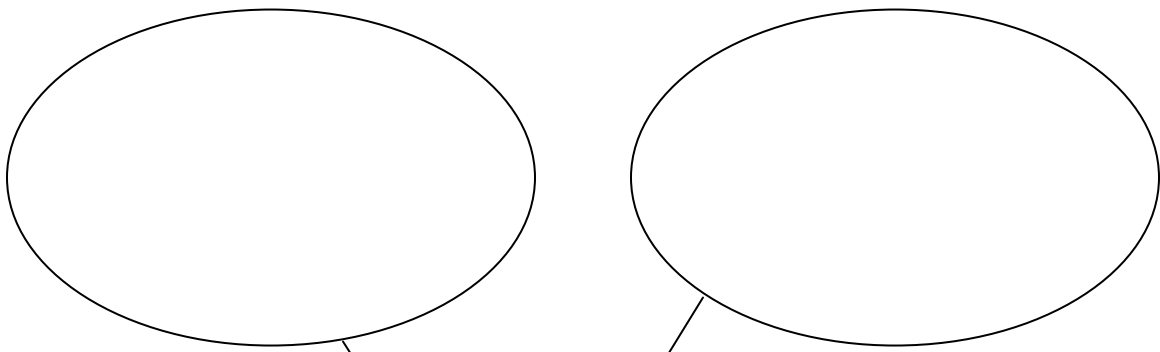


## Fact or Theory?

Evolution is unity.  
Evolution is diversity.

Which statement do you agree with and why????

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_



\*Fit doesn't  
necessarily  
mean  
strongest!☺



# Physical and Behavioral Adaptations Notes

<u>Habitat:</u>	Where an organism lives.
<u>Niche:</u>	The role of an organism in its environment.
<u>Adaptations:</u>	Changes that help an organism to survive in its environment.
<u>Physical Adaptations:</u>	A change in the organism's body structure. Ex. : homologous structures
<u>Homologous Structures</u> --	Structures that have somewhat different forms and functions, but form in similar ways and share like arrangements.
<u>Behavioral Adaptations:</u>	Actions an organism performs in order to survive. Ex.: birds migrate, hibernation, dogs hunt in packs
<u>Diversity:</u>	A number of differences in behavioral or physical adaptations.
<u>Fitness:</u>	A combination of physical and behavioral adaptations an organism has in order to survive.
<u>Natural Selection:</u>	Nature chooses which organisms are best suited (adapted) for survival.
<u>Survival of the Fittest:</u>	Organisms best adapted to their environment survive and reproduce.
<u>Form Follows Function:</u>	The shape of a body part is related to its function.

# Understanding Evolution: Homology and Analogy

Go to: [http://evolution.berkeley.edu/evolibrary/article/0\\_0\\_0/similarity\\_hs\\_01](http://evolution.berkeley.edu/evolibrary/article/0_0_0/similarity_hs_01)

1. a) In the image, which pair represents an analogy and which a homology? Write in the box below the picture.

b) Define homology:

c) Define analogy:

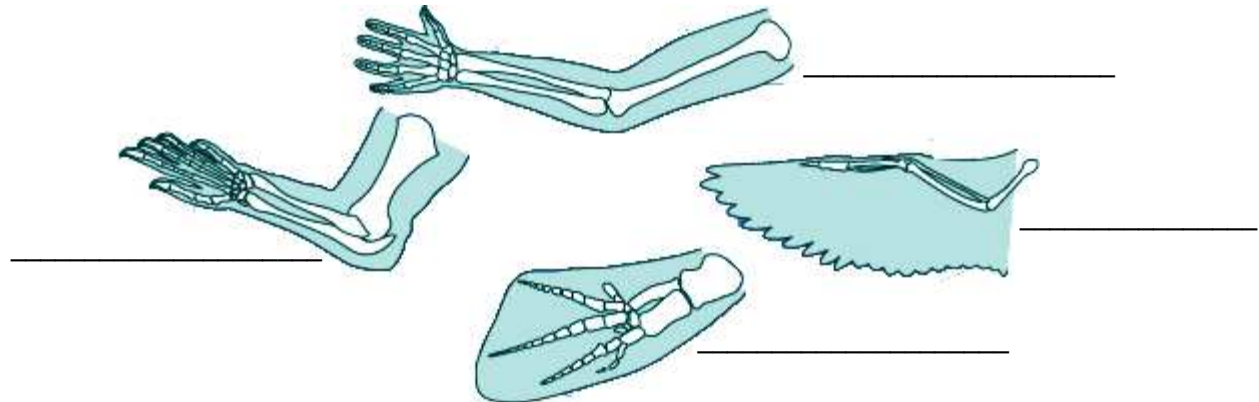


2. What is a tetrapod?

3. How are tetrapod bones similar to one another?

4. What are the six bones found in all tetrapod legs?

5. Identify these limbs (to what animal do they belong)?



6. What did the common ancestor of all modern tetrapods look like?

7. What types of traits can be inherited?

8. What structure on elephants and beavers are homologous? Why do they look so different?

9. Side Trip: "not just anatomy." - How are a bird and a crocodile homologous?

10. Similar structures that evolved independently are called \_\_\_\_\_.

11. a) What is the difference between a marsupial and a placental?

b) What is Smilodon?

c) What is Thylacosmilus?

12. Describe how two unrelated flowers could evolve to have a similar appearance?

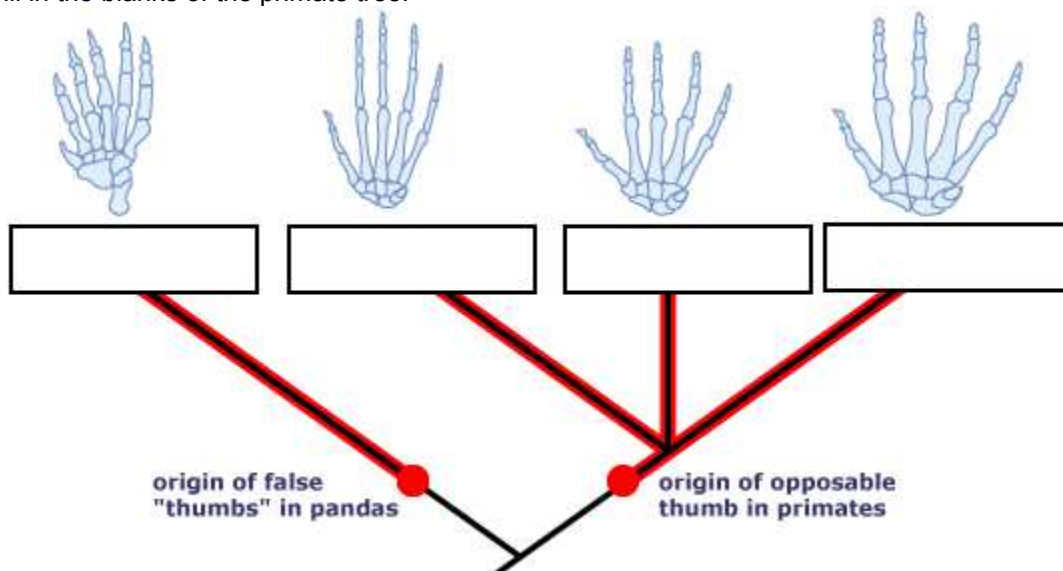
13. Are similarities between sharks and dolphins homologous or analogous?

Take a side trip: Examples of homology

14. What is morphology?

15. What three criteria are used to determine whether something is a homology or analogy?

16. Fill in the blanks of the primate tree.



17. Considering all of the evidence, are the "wings" (actually flaps of skin stretched between the legs) of sugar gliders and flying squirrels homologous or analogous structures? Explain why you would conclude this.

18. Sidetrip: See more examples of homology.

a) How are a venus fly trap and a pitcher plant homologous?

b) How are ears and jaws related?

c) Which homology do you find the most interesting from all in this "side trip"? Why?

19. Sidetrip: See more examples of analogy.

a) How are barnacles and limpets alike? How can these similarities be explained?

b.) Describe the analogy between an anteater and an echidna.

c) Which analogy do you find the most interesting from all on this "side trip"? Why?

20. What was the most useful part of this webquest?

21. Do you find that you understand evolution, homologous, & analogous structures better? Why or why not?

Name \_\_\_\_\_ Period \_\_\_\_\_

## Lab Investigation: Who's Related to Whom?

Natural selection and evolution would predict that species which diverged from one another relatively recently in the history of life on Earth will share more genetic similarities than species that diverged from one another earlier. Because proteins are programmed by genes, a comparison of the amino acid sequence of their proteins would indicate the relatedness among species.

**Problem:** How can you predict the degree to which species are related from the amino acid sequences in their proteins?

**Materials:** Data table of amino acid sequences of the protein cytochrome-c. (**Remember from the electron transport system?** ☺)

### Procedure:

1. Use the amino acid sequences to calculate the percentage difference between a fruit fly and a sunflower. To calculate the percentage difference between two species, determine the number of amino acids that differ between the two species, then divide that number by the total number of amino acids in the sequence. (The sequences provided have 60 amino acids.)
2. **Make an appropriate prediction regarding the percentage difference of the cytochrome-c amino acid sequences of a human and a chimpanzee. Record this information in a data table.**
3. To test your prediction, repeat step 1 for a human and a chimpanzee.
4. Repeat steps 1 to 3 using the amino acid sequences of a horse and a donkey.
5. Repeat steps 1 to 3 using the amino acid sequences of a chicken and a turkey.
6. Repeat steps 1 to 3 using the amino acid sequences of birds, rattlesnakes, and mammals.
7. Repeat steps 1 to 3 using the amino acid sequences of an animal and the sunflower (plant) or yeast (fungus).

Human	GDVEKGKKIFIMKCSQCHTVEKGGKHKTGPNLHGLFGRKTGQAPGYSYTAANKNKGIIWG
Chimpanzee	GDVEKGKKIFIMKCSQCHTVEKGGKHKTGPNLHGLFGRKTGQAPGYSYTAANKNKGIIWG
Rhesus monkey	GDVEKGKKIFIMKCSQCHTVEKGGKHKTGPNLHGLFGRKTGQAPGYSYTAANKNKGITWG
Horse	GDVEKGKKIFVQKCAQCHTVEKGGKHKTGPNLHGLFGRKTGQAPGFYTDANKNKGITWK
Donkey	GDVEKGKKIFVQKCAQCHTVEKGGKHKTGPNLHGLFGRKTGQAPGFSYTDANKNKGITWK
Chicken	GDIEKGKKIFVQKCSQCHTVEKGGKHKTGPNLHGLFGRKTGQAEGFSYTDANKNKGITWG
Turkey	GDIEKGKKIFVQKCSQCHTVEKGGKHKTGPNLHGLFGRKTGQAEGFSYTDANKNKGITWG
Rattlesnake	GDVEKGKKIFTMKCSQCHTVEKGGKHKTGPNLHGLFGRKTGQAVGYSYTAANKNKGITWG
Fruit fly	GDVEKGKKLFVQRCAQCHTVEAGGKHKVGPNLHGLIGRKTGQAAGFAYTNANKAKGITWQ
Sunflower	GDPTTGAKIFKTKCAQCHTVEKGAGHKQGPNLNGLFGRQSGTTAGYSYSAANKNMAVIWE
Baker's yeast	GSAKKGATLTKTRCELCHTVEKGGPHKVGPNLHGIFGRHSGQAQGYSYTDANIKNVLTWD
<p>The letters represent the amino acids as shown:            G=glycine, A=alanine, V=valine, L=leucine, I=isoleucine, M=methionine, F=phenylalanine, W=tryptophan, P=praline, S=serine, T=threonine, C=cysteine, Y=tyrosine, N=asparagines, Q=glutamine, D=aspartic acid, E=glutamic acid, K=lysine, R=arginine, and H=histidine.</p>	

**Data:**

_____ (species) _____ vs _____ (species) _____	Predicted % difference	Actual % difference
Fruit fly vs Sunflower		
Human vs Chimpanzee		
Horse vs Donkey		
Chicken vs Turkey		
Turkey vs Rattlesnake		
Horse vs Rattlesnake		
Turkey vs Horse		
Horse vs Yeast		

**Observations:**

1. How different are humans and chimps in the first 60 amino acids of the cytochrome-c sequence? \_\_\_\_\_
2. What pattern of relatedness did you observe from the percentage differences among various species? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Analysis and Conclusion:**

1. Which species share recent common ancestors? \_\_\_\_\_  
\_\_\_\_\_  
Distant common ancestors? \_\_\_\_\_  
\_\_\_\_\_
2. Would you be able to draw a “family tree” of the organisms named, showing when they diverged from one another? Explain. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. Some positions on the amino acid sequence are the same for all cytochrome-c molecules shown. Why might this be so? (Remember this molecule is part of the electron transport chain.) \_\_\_\_\_  
\_\_\_\_\_
4. As a rule, what general conclusions can you draw regarding how closely related species are and how their cytochrome-c amino acid sequences compare? \_\_\_\_\_  
\_\_\_\_\_



Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**Science World -- Nov. 13, 2000 Vol. 57, No. 5; -- "Animal Camouflage," pp. 8-12**

1. Look at the photo on page 8. Which moth is more likely to wind up being eaten by predators?
2. What is meant by camouflage?
3. What does camouflage enable animals to do?
4. How long have species been displaying camouflage?
5. Which sole species do biologists focus on?
6. Look at the photo on page 9. What does it mean when bugs are camouflaged by *disguise*?
7. Look at the photo on page 10. What does disruptive coloration, or camouflage by wild patterns do for the animal?
8. How many generations of peppered moths are produced in one year?
9. What does *monomorphic* mean?
10. What was the color of all known peppered moths in England during the mid-19<sup>th</sup> century?
11. By the end of the 19<sup>th</sup> century, what was the color of more than 90% of peppered moths?
12. What blackened the trees & contaminated the air in many parts of England since the 1850s?
13. What happened to the pale moths in their darkened habitat?

14. What was the advantage of a dark moth on a dark tree?
15. What happened to the moth population over time?
16. What is *fitness*?
17. What are adaptations?
18. According to Greenberg, what is a great adaptation?
19. What determines a species' survival when an environment changes?
20. What is natural selection?
21. Why has the number of dark peppered moths decreased to 5% of the population since 1959?
22. What is meant by disguise camouflage?
23. What is meant by mimicry camouflage?
24. What does the viceroy butterfly resemble?
25. What do monarch butterflies do to birds?
26. List the 2 examples the article gives of animals using disruptive coloration.