Biodiversity - Evidence for Evolution

INSTRUCTOR:
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Directions: Answer the following questions from your study thus far. Remember your resources!

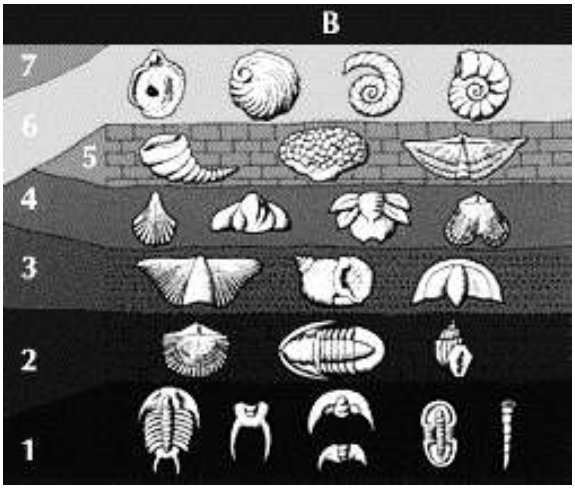
Name: _____

Background: Much evidence has been found to indicate that living things have evolved or changed gradually during their natural history. The study of **fossils** as well as work in **embryology**, **biochemistry**, **biogeography**, and comparative **morphology** provides evidence for evolution. Watch the video - https://youtu.be/P3GagfbA2vo : Crash Course Biology – Evidence for Evolution and answer the following

Objective: To compare homologous, analogous, and vestigial structures and analyze their significance in evolutionary history.

I. Fossils

Study the figure at right.



1. Which rock layer is the oldest? _____
2. Which rock layer is the youngest? _____
3. Explain what can scientists learn about evolution when comparing different fossils in different rock layers? (Use terms like relatedness, extinction, transition etc.) You must write at least two complete sentences.

II. Homologous Structures

4. Carefully examine the drawings of the bones in **Figure 1** on the next page. Look for similarities among the various animals.

a. Color each bone of the human arm a different color. All bones of the wrist (carpals) should be a single color, and the bone groups of the hand (metacarpals and phalanges) should be a another color. Then color the corresponding bones (containing the same pattern) in each of the other animals the same color as the human bone (i.e. if you color the humerus blue in the human, it should be blue in all the other animals).

b. Describe at least two *functions* of each set of bones below:

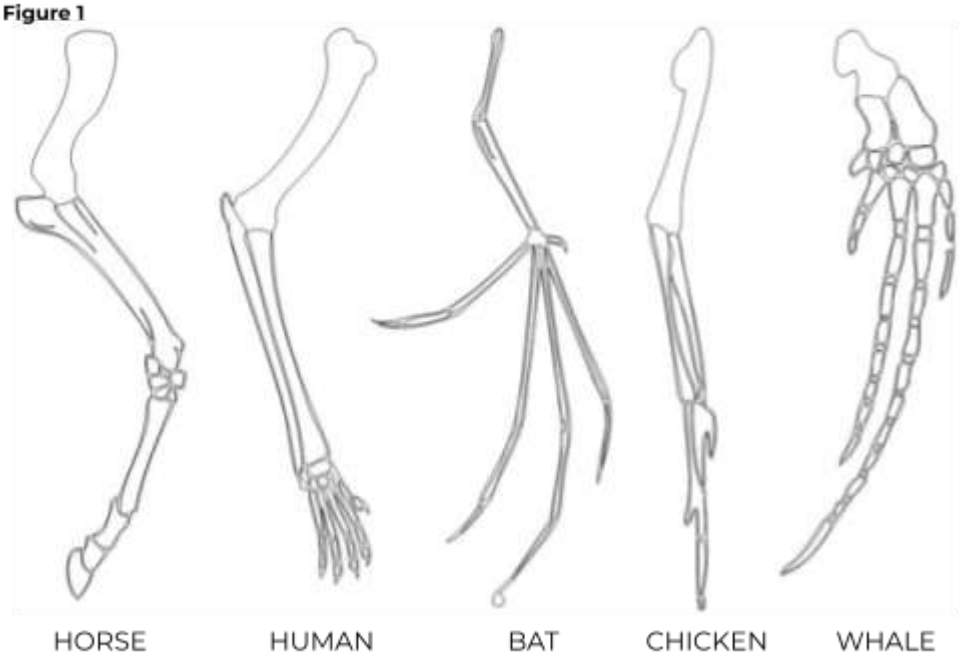
Animal	Functions	
Human		
Whale		
Cat		
Bat		
Bird		
Crocodile		

Table 1

c. Are the bones arranged in a similar way in each animal? _____

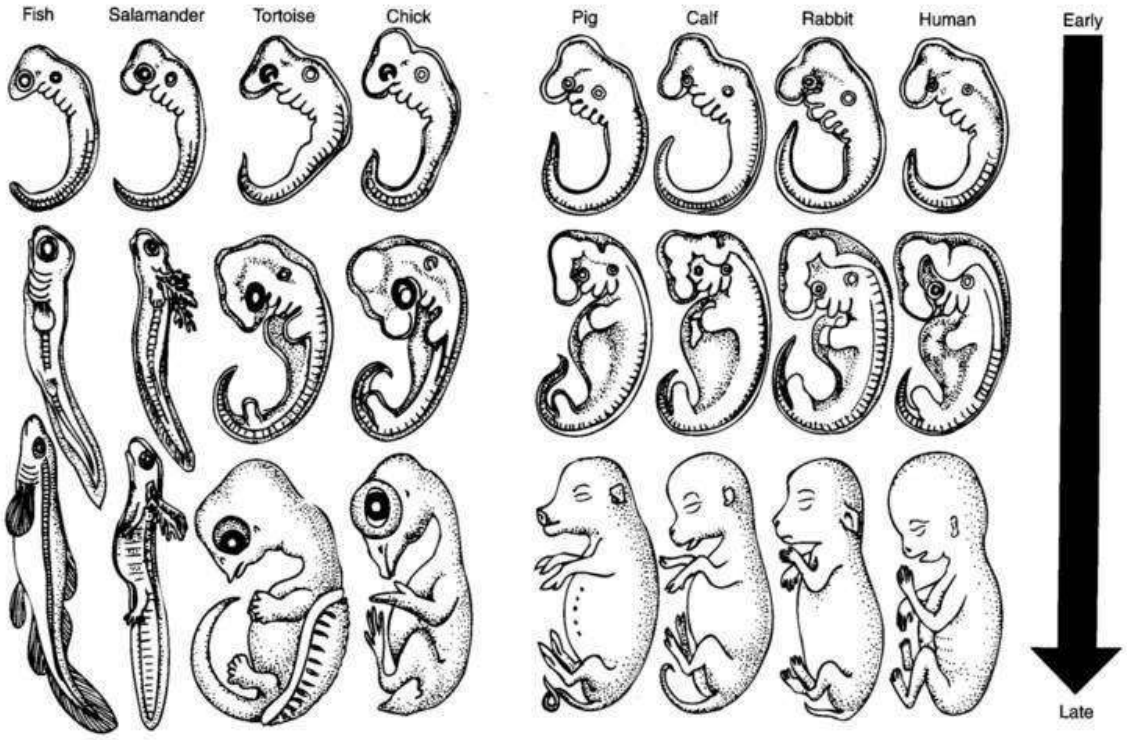
These structures on the following page are *formed* in similar ways during embryonic development and share like *arrangements*; however, they have somewhat different forms and functions. They are called *homologous structures*. **What does the prefix "homo" mean? _____**

Figure 1



III. Embryology

5. Using complete sentences, describe how comparing early development can help scientists learn about the relatedness of species. Give an example!



IV. Analogous structures

6. Examine the butterfly wing and the bird wing shown in **Figure 2**.

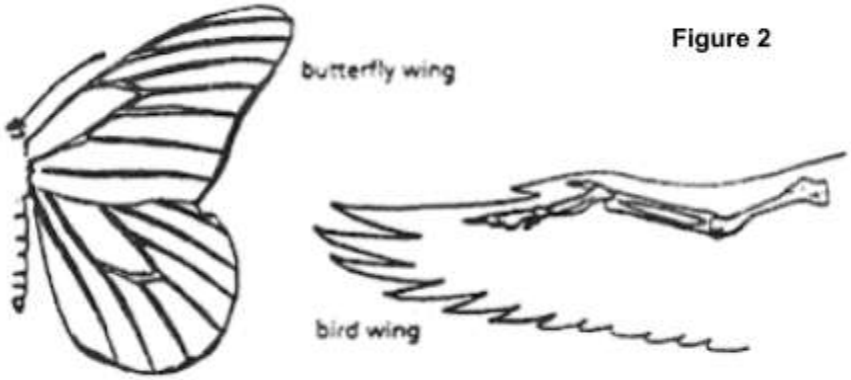


Figure 2

a. What function do these structures share?

b. How do the structures differ internally and externally? (give me three)

c. Do birds and insects share any structural similarities that would suggest they are closely related in the single tree of life that includes all organisms? Explain.

Some apparently **unrelated** animals have organs with similar functions, yet are very different in structure and form. These structures are called *analogous structures*.

V. Vestigial structures

Gradual changes have occurred through time that have, in some cases, reduced or removed the function of some body structures and organs. The human appendix that is reduced and no longer digests rough vegetation and pelvic bones of snakes that have no legs are examples of this phenomenon.

1. The cave fish and minnow shown in **Figure 3** are related, but the cave fish is blind.

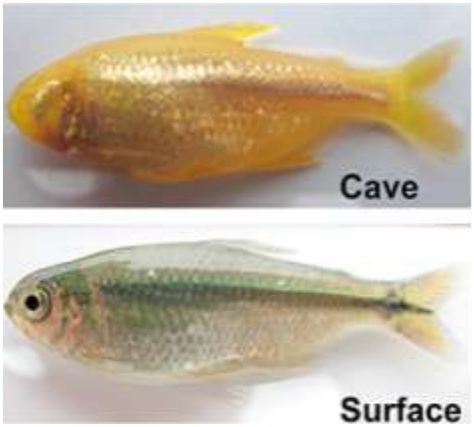


Figure 3

a. Explain why eyesight is not an important adaptation to life in a **cave**.

b. Do the appearance of the cave fish and minnow suggest common ancestry? Explain.

Organs or structures that have lost their function in the organism and have become reduced in size (because of efficiency) are called **vestigial structures**.

2. Read the list of human vestigial structures shown in **Table 2**. Suggest a possible function for each structure and explain why it became vestigial (why that adaptation became less important for survival). Think about organisms that are closely related to us and the functions they have for those structures (meaning other mammals or specifically other primates). Record your answers in the table. For the second part, analyze why this function is no longer needed (has a different structure taken over that function? Has the environment changed?)

Table 2

Structure	Possible Function(s)	Why it is considered vestigial
Appendix		
Muscles that make hair stand up		
Coccyx (tail bone)		
Muscles that move ears		
Wisdom teeth		

Analysis and Interpretations

1. Explain why the homologous structures in Part II are evidence of evolutionary relationships.

2. Explain the evolutionary relationship between the fin of a fish and the flipper of a whale (a mammal).

3. List two structures (not found in Table 2) that you think are *vestigial* and why. These structures can be from any living organism, not just humans.

4. What is the appendix homologous to in other mammals? What do homologous structures indicate?

5. If a scientist states that two species are closely related based on morphology, what would you expect a comparison of their DNA base sequence to reveal?

VI. Biogeography

Analyze Figure 4 right- answer the questions that follow -

6. What factors could have contributed to the distribution of certain plant and animal species across Pangea, as shown on the map?

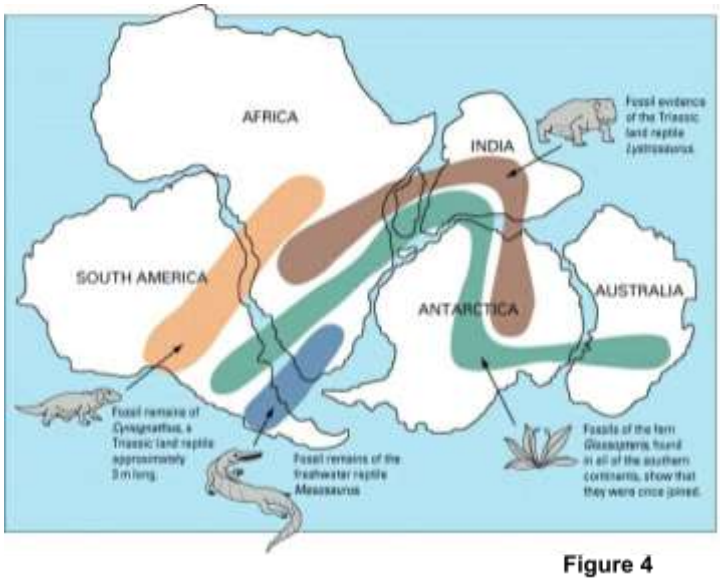


Figure 4

7. How might the movement of tectonic plates over time have influenced the distribution of species on Pangea, as depicted on the map?

8. Based on the fossil record, what evidence can we gather about the climate and environmental conditions on Pangea during this time period?

9. What patterns or trends emerge when comparing the distribution of plant species to the distribution of animal species on Pangea, as shown on the map?

10. How might the distribution of species on Pangea have impacted the evolutionary paths of certain plant and animal groups, and what implications might this have for modern-day ecosystems?

VII. Molecular Biology

Despite the fact that poison tree frogs and humans are vastly different in appearance and biology, there are some genetic similarities between the two species. Both poison tree frogs and humans are vertebrates and therefore share a basic genetic blueprint that includes genes for the development of organs, limbs, and nervous systems. In addition, both species have genes that regulate the immune system, which helps protect against disease.

One particular area of genetic similarity between poison tree frogs and humans is in the genes that encode for skin peptides. Poison tree frogs produce a variety of toxic skin peptides that help protect them from predators, while humans produce a variety of antimicrobial peptides that help protect against bacterial and fungal infections. These peptides have similar structures and functions, despite their different origins.

11. What is the basis of genetic similarity between poison tree frogs and humans?

12. How do the genes that regulate the immune system protect both poison tree frogs and humans?

13. What is the significance of skin peptides for both poison tree frogs and humans?

14. What are the similarities and differences between the skin peptides produced by poison tree frogs and humans?

15. How do the different functions of the skin peptides produced by poison tree frogs and humans relate to their respective environments and lifestyles?

16. Could the genetic similarity between poison tree frogs and humans be exploited to develop new treatments for human diseases? Explain your answer.

17. How might the production of toxic skin peptides in poison tree frogs have evolved, and what implications does this have for understanding the evolution of defense mechanisms in other species?

18. How might the study of the genetic similarities between poison tree frogs and humans contribute to our understanding of the basic principles of evolution and natural selection?

Analyze:

19. Complete the table below and answer the associated questions:

Animal	Amino Acid Sequences in Cytochrome-c																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Horse	gln	pro	phe	thr	thr	ala	lys	asn	lys	thr	lys	glu	glu	thr	leu	met	glu	lys	ala	thr	asn	glu
Chicken	gln	glu	phe	ser	thr	asp	lys	asn	lys	thr	gly	glu	asp	thr	leu	met	glu	lys	ala	thr	ser	lys
Frog	gln	ala	phe	ser	thr	asp	lys	asn	lys	thr	gly	glu	asp	thr	leu	met	glu	ser	ala	cys	ser	lys
Human	gln	pro	tyr	ser	thr	ala	lys	asn	lys	ile	gly	glu	asp	thr	leu	met	glu	lys	ala	thr	asn	glu
Shark	gln	gln	phe	ser	thr	asp	lys	ser	lys	thr	gln	gln	glu	thr	leu	arg	ile	lys	thr	ala	ala	ser
Monkey	gln	pro	tyr	ser	thr	ala	lys	asn	lys	thr	gly	glu	asp	thr	leu	met	glu	lys	ala	thr	asn	glu
Rabbit	gln	val	phe	ser	thr	asp	lys	asn	lys	thr	gly	glu	asp	thr	leu	met	glu	lys	ala	thr	asn	glu

Number of Amino Acid Differences from Human Cytochrome-c	
Species	**Number of Differences from Human**
Horse	
Chicken	
Frog	
Shark	
Monkey	
Rabbit	

20. If you were to look at your results, list the organisms least to most related to humans.

Summary

As you've come to the end of this assignment - what questions still linger regarding the Evidences for Evolution? (**Provide at least 2**)