**Evidence for Evolution** 

# **A. HOMOLOGOUS STRUCTURES**



There are many examples of body structures that are formed in similar ways during embryonic development and that share similar patterns of bone structure, even though they take on different forms and perform somewhat different functions in the adult forms of the animals. These structures are called **homologous structures**. *Homo-* means same, and *-logous* means information, so *homologous* means "same information". Homologous structures mean that the animals share a relatively recent common ancestor.

#### **INSTRUCTIONS:**

1. Carefully examine the drawings of forelimb skeletons shown in Figure 1. Look for similarities in the bones amongst the various animals.

2. <u>Color in the human arm first.</u> Color the bones of the arm (the humerus, ulna, and radius) one color. Color the bones of the hand (the carpal, metacarpals, and phalanges) another color.

3. Color the corresponding bones in each of the other animals <u>the same color as the human bones.</u>

4. Observe each of the skeletons again, and describe the function of each limb in the table on the next page. The first one is done for you:

5. Are the functions of the limbs of each of the animals illustrated the same or different?

6. Are the bones of the limbs<u>arranged</u> in a similar or in a very different way in each animal?

	10
Animal	Function
human	Picking things up, using tools, etc.
whale	
cat	
bat	

7. Does the similarity in bone structure suggest a common ancestry amongst these animals?\_\_\_\_\_

8. Explain how homologous structures are evidence of a common ancestor.

## **B. VESTIGIAL STRUCTURES**

There are also many examples of body structures in animals that show gradual changes over time. In some cases, these changes have reduced or removed the function of some body parts and organs. These reduced or lost structures are called **vestigial structures**. The wings of penguins and the leg bones of snakes are examples of this phenomenon.

9. Below is a list of human vestigial structures. Suggest a possible function for each structure and explain why it is considered vestigial.

Structure	Probable Function in ancestor	Why Considered Vestigial?
Appendix		
Coccyx (tail bone)		
Muscle that moves ears		
Muscles that makes hair stand up		

10. Why are vestigial structures evidence for evolution?

### **C. ANALOGOUS STRUCTURES**

Some animals have similar traits, but these traits evolved as **separate** adaptations to perform the same function (aka flying). These structures are called **analogous structures**. Analogous structures **DO NOT show evidence of 2 organisms being closely related to each other**. In fact, they show the opposite. The similar appearances show convergent evolution- adaptations that evolved

independently in because of similar selection pressures. Figure 2.

Examine the butterfly wing and the bird wing shown in Figure 2. Look for any similar bone structure.

11. Explain why these are considered analogous structures and not homologous structures.



12. Are organisms with homologous or analogous structures more closely related?\_\_\_\_

Explain your answer!

**13.** Explain the evolutionary relationship between the fin of a fish and the flipper of whale. (hint: The inside of a fish fin is built very differently from a whale flipper)



## D. Fossil Evidence: The Horse

**Fossil Bone Structure.** Examine the fossils of toe structure and teeth for each species. Bone structure and teeth can be used to determine how each animal was adapted for its environment and the type of food it ate. Notice how the number and shape of horse toes changed over time. Notice also how the size and the environment of the horse changed over time.

14. Fill in the chart below:

Horse	# of	MYA (million
Species	toes	years ago)
Eohippus		
Miohippus		
Merychippus		
Pliohippus		
Equus		

15. How does the shape and size of the horse fossils demonstrate evolution by me4ans of natural selection?

#### E. EMBRYOLOGY

All vertebrate embryos follow a <u>common developmental path due to their common ancestry</u>. All have a set of very similar genes (the homeobox genes) that define their basic body plan. As they grow, the differences that will distinguish the embryos as adults become more and more apparent. The study of this development can yield insights into the process of evolution.From http://www.pbs.org/wgbh/evolution/library/04/2/1\_042\_03.html



Look at the diagram below. This shows the embryonic development of 8 different vertebrate animals (animals with backbones).

16. List three similarities between the embryos at the second stage (II): Circle them.

17. Explain how the similarities that you mentioned in #16 correlate to the evolutionary relatedness of the vertebrates above.

## **MOLECULAR BIOLOGY (DNA Evidence)**



F.

A fragment of aligned DNA sequences that codes for a protein common to each primate species and the chromosome banding patterns for the third chromosomes of each species are depicted below. Changes in the DNA sequences are underlined. Discuss how you would interpret the relationships between these organisms based on the genetic and chromosomal data given on this page.

18. Look at the DNA evidence above. Compare the 3 primates to humans (Homo sapiens) and count the differences in the bases of DNA compared TO THE HUMAN.

Species	Number of differences compared to the human
Pan troglodytes	
Gorilla gorilla	



evolution? BE SPECIFIC!!

are related in terms of

21. Which piece of evidence has the newest, most accurate information on how organisms are related?

22. Your friend says, "I don't believe in evolution". HOW do all of the topics we studied in this packet actually provide evidence for evolution? Answer this question generally and then use one specific piece of evidence as an example to support your answer.