

# Evidence of Evolution

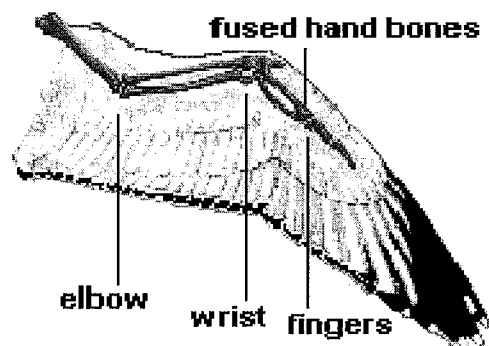
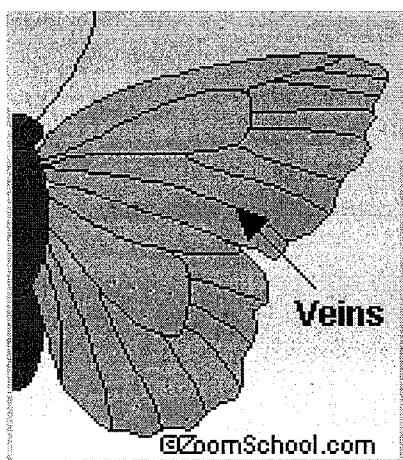
**Objective:** to become familiar with the evidence that supports the concept of evolution and evolutionary theory

## Part One: Homologous Structures

1. **Homologous structures:** Structures that have formed in similar ways during embryonic development and share similar arrangements. However, these structures have different forms and functions.
2. Carefully examine the drawings of the bones illustrated in Figure 1. Note the similarities in arrangements of the bones among these organisms
  - a. Color each part of the human arm a different color. For example, color the humerus red, then the two bones of the forearm a different color, and so on.
  - b. Color the corresponding ones of the other animals in the same color as you chose for the human.
3. Create a table in which you indicate the animal and a description of the function of each set of bones pictured in Figure 1.
4. Why are the bones in each of the organisms depicted in Figure I considered to be homologous?

## Part II: Analogous Structures

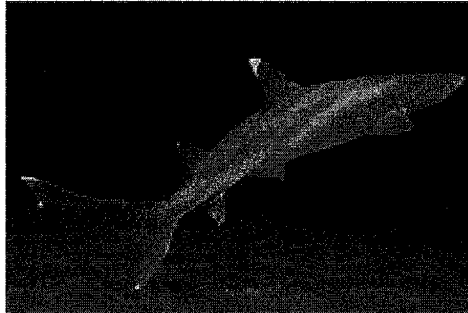
1. **Analogous structures:** structures that have similar function in different organisms but are very different in their structure and form.
2. Study the illustrations of the butterfly wing and the bird wing below. Why are these analogous structures?



### 3. Homologous or Analogous?

Study the pictures below of a shark and a dolphin. Notice that they both have a streamlined body shape and a triangular fin on their backs and two side fins which allow them to swim faster.

**Shark**



skeleton made of cartilage

use gills to get oxygen from the water in which they swim

don't nurse their young

don't have hair

**Dolphin**



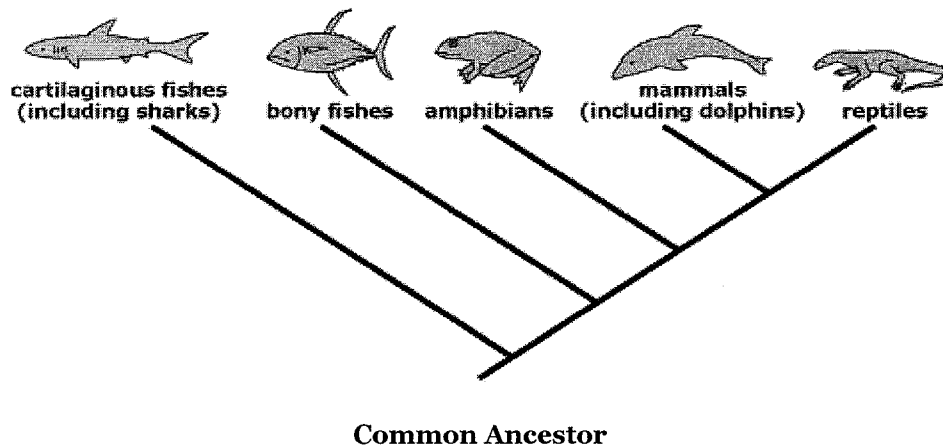
skeleton made of bone<>

go to the surface and breathe atmospheric air in through their blowholes

do nurse their young

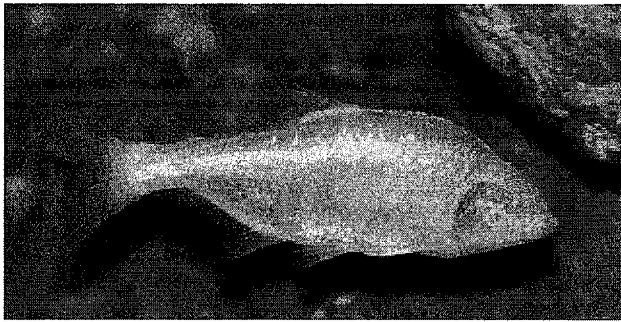
do have hair — they are born with hair around their "noses"

The "tree of life" below illustrates how sharks and dolphins have evolved over time. Based on this information, do you think that the body shape and fins of these two animals are homologous or analogous? Explain your answer.

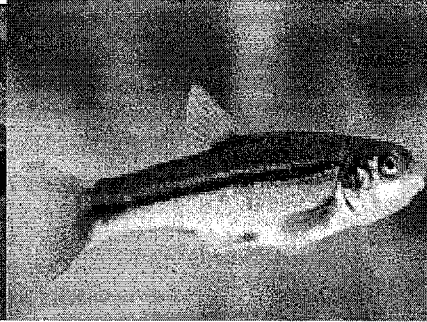


### Part III: Vestigial Structures

1. **Vestigial Structures:** Gradual changes over time have in some cases reduced or eliminated the function of certain body structures or organs in different organisms. For example, the appendix in humans no longer has any function.
2. Examine the pictures below of the minnow and the cave fish.
3. Why would the eyes of the cave fish be considered vestigial?



Cave Fish



Minnow

4. Eyesight requires a great deal of energy expenditure. Hypothesize as to why the cave fish diverged from the minnow to become a separate species. It may help in answering this question to read about Darwin's Theory of Natural Selection (overpopulation, competition, survival of the fittest, and reproduction of offspring) to help you formulate your hypothesis.
5. Make a table of the following structures, with a column hypothesizing the probable function of each of these functions, and another column indicating why each of these structures are vestigial. (you may need to use a textbook or the Internet to help you with these answers.)
  - ◆ Appendix
  - ◆ Coccyx (tail bone)
  - ◆ Muscles that move the ears
  - ◆ Little toe
  - ◆ Wisdom teeth

#### Part IV: Comparative Embryology

1. Examine the illustrations of embryos in Figure 2. See if you can correctly match the embryo with the animals by placing them in order from the earliest to latest stages of development. Copy the chart below onto to your lab paper and write the numbers of the pictures in the proper order under the correct animal.

	<b>Fish</b>	<b>Chick</b>	<b>Pig</b>	<b>Calf</b>	<b>Human</b>
<b>Stage I</b>					
<b>Stage II</b>					
<b>Stage III</b>					

2. Explain why you ordered the drawing they way you did.
3. Describe the patterns you observed as the embryos move from Stage I to Stage III.
4. The backbones and limbs of all 4-limbed vertebrates (called tetrapods) are identical in embryonic origin and underlying structure. They are all constructed from the same sets of embryonic tissues, supported by the same sets of bones and moved by same sets of muscles. These similarities reinforce the notion that all tetrapods have descended, with various modifications, from a common ancestor. How does embryological development of vertebrates provide evidence of evolution?

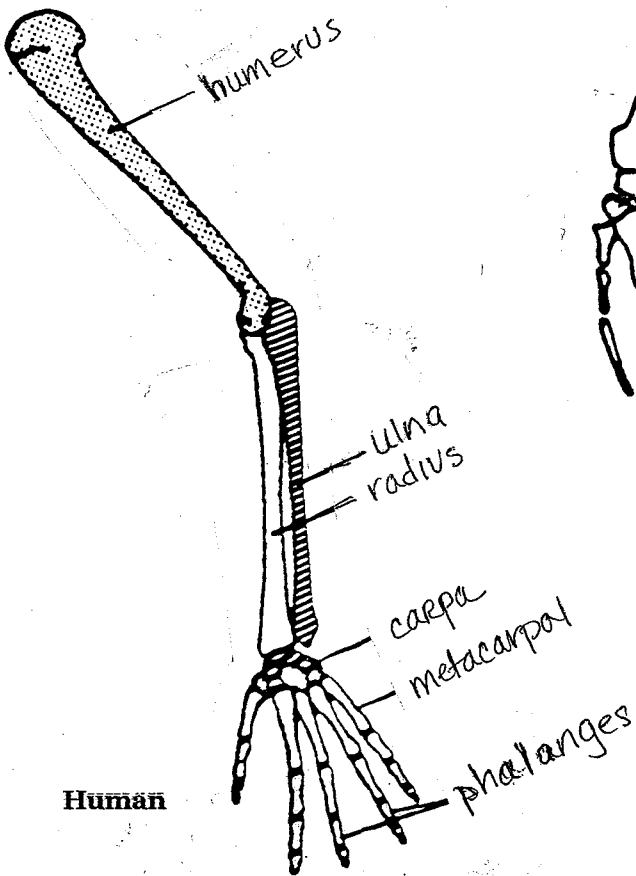
## Part V: Check Your Embryological Chart

1. Compare your work from Part IV with the following answer key and then answer the following questions.
2. How accurate were you in ordering the stages of development for each organism? Explain with specific examples from your chart.
3. For which organism(s) were you most accurate in ordering. Provide a possible explanation of why you were able to properly sequence the stages of these organisms in particular.
4. During which stages was it difficult to decipher if the embryo was that of a pig, chicken, human. Provide an explanation of your answer.
5. What do the results of your chart suggest about the evolutionary relationships of these organisms?

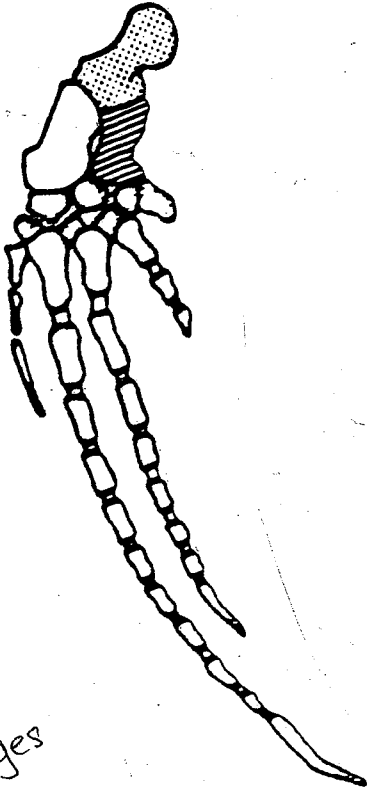
## Conclusions

1. Explain why homologous structures provide evidence of evolution.
2. Describe the evolutionary relationship between the fin of a fish and the flipper of a whale.
3. **Comparative Biochemistry** refers to comparisons among organisms with respect to hormones, enzymes, proteins, DNA, and other biochemical compounds. How can comparative biochemistry provide evidence of evolutionary relationships and common ancestry?

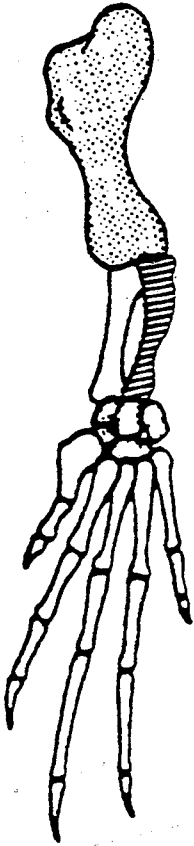
**Figure 1: Homologous Structures**



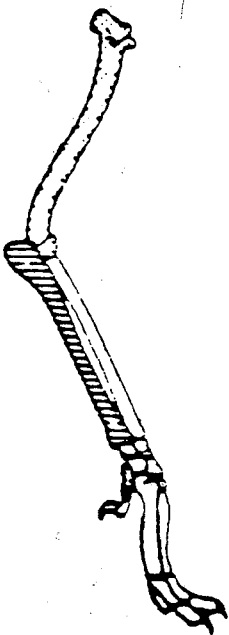
**Human**



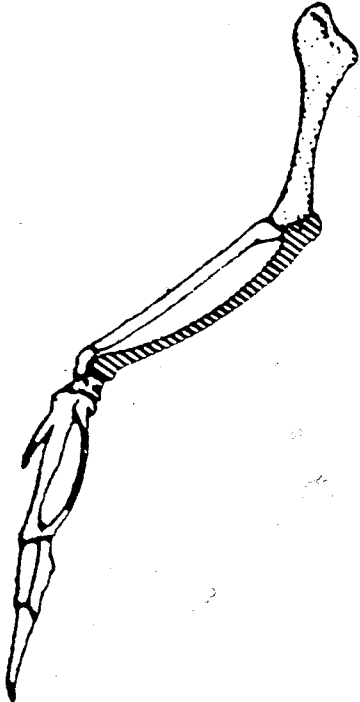
**Whale**



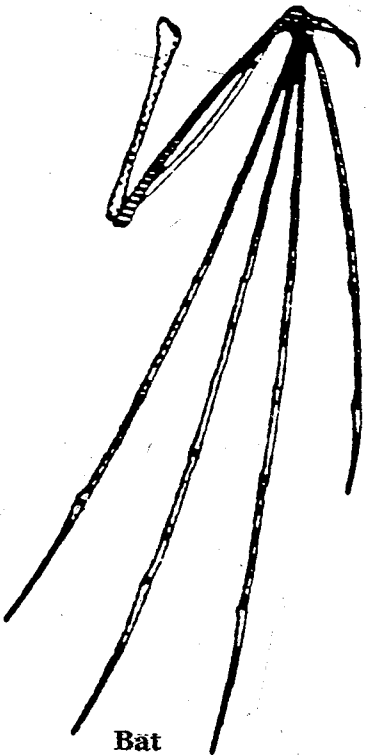
**Crocodile**



**Cat**



**Bird**



**Bat**

**Figure 2: Embryological Development**

