Evidence for Evolution

N	ame

Part I: The picture below shows the forelimbs of mammals and how the bone structures are similar. Create a key for coloring, color each structure, and then answer the questions on the next page.



Part I Questions:

- 1. Using your text, what is adapative radiation?
- 2. What is the common function of all these forelimbs?
- 3. Describe at least one similarity in the structure of mammalian forelimbs.
- 4. How do these similarities support the Theory of Evolution?

Part II: The picture shows embryonic development of several. Use it to answer the questions below.



Part II Questions:

- 5. At which stage is it the most difficult to tell the embryos apart? (I, II, or III)
- 6. Describe at least one similarity in the structure of these embryos
- 7. How do these similarities support the Theory of Evolution?

Part III: Fossil evidence strongly supports the evolution of whales. Scientists believe that the ancestors of the modern whale had once lived on land. Fossil evidence of *transitional species* supports this idea. On the sheet labeled "Whales in the making," cut out the 6 whale ancestors and put them in order you think they go in. The numbers they are labeled with do not give you any clues, but be sure to leave them on. Glue them in the space below. The oldest ancestor will be near the top of the page. **Observe the forelimbs and hindlimbs to figure out the correct order.**

Part III Question:

8. Summarize how the whale evolved from a land mammal (ancestors) to a marine mammal (modern whale). Your summary only needs to describe the physical changes and you must write in 3-5 complete sentences.

Part IV: Examining the relationships between biological molecules, such as proteins or DNA can tell scientists how closely related organisms are. The more similar these molecules are, the more recently the organisms had a common ancestor. Follow the directions for each table.

1. There are 146 amino acids in the protein hemoglobin. This table shows a portion of the amino acid sequence for hemoglobin for 6 different mammals. Circle or highlight the amino acids in the chimp, gorilla, monkey, horse, and kangaroo sequences that differ from those in the human sequence.

Amino Acid # →	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101
Human	thr	leu	ser	glu	leu	his	cys	asp	lys	leu	his	val	asp	pro	glu
Chimp	thr	leu	ser	glu	leu	his	cys	asp	lys	leu	his	val	asp	pro	glu
Gorilla	thr	leu	ser	glu	leu	his	cys	asp	lys	leu	his	val	asp	pro	glu
Rhesus Monkey	gln	leu	ser	glu	leu	his	cys	asp	lys	leu	his	val	asp	pro	glu
Horse	ala	leu	ser	glu	leu	his	cys	asp	lys	leu	his	val	asp	pro	glu
Kangaroo	lys	leu	ser	glu	leu	his	cys	asp	lys	leu	his	val	asp	pro	glu
							1	1	1	1	1		1		
Amino Acid # →	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116
Human	asn	phe	arg	leu	leu	gly	asn	val	leu	val	cys	val	leu	ala	his
Chimp	asn	phe	arg	leu	leu	gly	asn	val	leu	val	cys	val	leu	ala	his
Gorilla	asn	phe	lys	leu	leu	gly	asn	val	leu	val	cys	val	leu	ala	his
Rhesus Monkey	asn	phe	lys	leu	leu	gly	asn	val	leu	val	cys	val	leu	ala	his
Horse	asn	phe	arg	leu	leu	gly	asn	val	leu	ala	leu	val	val	ala	arg
Kangaroo	asn	phe	lys	leu	leu	gly	asn	ile	ile	val	ile	cys	leu	ala	glu

2. The table shows the number of amino acids in *cytochrome c* that differ between several organisms and humans. *Cytochrome c* is a protein found in mitochondria. It is often studied because most organisms have mitochondria and therefore they have cytochrome c. Rewrite the information in the blank table by listing the organisms IN ORDER with the greatest number of differences at the top and the least at the bottom.

Species Comparison	# of differences
Human—chimp	0
Human—fruit fly	29
Human—horse	12
Human—pigeon	12
Human—rattlesnake	14
Human—red bread mold	48
Human—rhesus monkey	1
Human—screwworm fly	27
Human—snapping turtle	15
Human—tuna	21
Human—wheat	43

Species Comparison	# of differences

Part IV Questions: Use all of the above tables to answer the questions below.

9. On the basis of hemoglobin similarity, which organism appears to be most closely related to humans? least related?

10. On the basis of cytochrome c similarity, which organism appears to be most closely related to humans? least related?

11. If the amino acids sequences in the proteins of two organisms are similar, why will their DNA also be similar?

12. Many biologists believe that the number of differences between the proteins of different species indicates how long ago the species diverged from a common ancestor. Why do these same biologists believe that humans, chimps, and gorillas diverged from a common ancestor only a few million years ago?

WHALES IN THE MAKING



