

Evidence of Evolution

Essential Question: What types of evidence support common ancestry and biological evolution?

Introduction

Scientists apply evolutionary theory to different types of evidence to explore how species are related to one another. They might study fossils to identify similarities among extinct species and living ones. They might look for evolutionary relationships among living species by comparing anatomy, both in embryos and adult organisms, or by comparing genes and proteins. Biogeography, which is the study of the geographic distribution of species, can also provide clues to common ancestry.

In this lab, you will be investigating molecular evidence for evolution. Your goal is to determine the most likely evolutionary relationship between four living species.

Procedure

Part A: Plan Your Investigation

1. You will be determining the evolutionary relationship between eight different species. One species is humans (*Homo sapiens*). The other species are: brown bear, chimpanzee, gibbon, gorilla, spider monkey, mouse, and shrew.
2. Consider what you already know about each species that you selected to apply this knowledge. Make a prediction by ranking the species in order from most recent common ancestor with humans to least recent common ancestor with humans.

_____ <—————most recent common ancestor w/ humans

_____ <—————least recent common ancestor w/ humans

Part B: Comparing Amino Acid Sequences in Hemoglobin

Hemoglobin is the molecule in blood that carries oxygen. This complex molecule contains four protein chains. **Figure 1** shows the amino acid sequence for one of those chains in eight mammals. Each letter stands for a different amino acid. Each column is a location on the protein chain. NOTE: Not shown are the locations where the amino acids are identical among all eight mammals.

3. Use the row labeled "Human" as your control. Compare the sequence for the the first of the other species in your list to the sequence for humans. Highlight every difference you identify.
4. Repeat Step 3 for the other mammals in your list. Be sure to compare each sequence to the sequence for humans.
5. Use the data table on the next page to record the number of differences you found for each species in comparison to humans.

Mammal	Number of amino acid differences (compared to humans) in hemoglobin

6. Draw conclusions. Based on the evidence you obtained, rank each of the species in order from most differences with humans to fewest differences with humans.

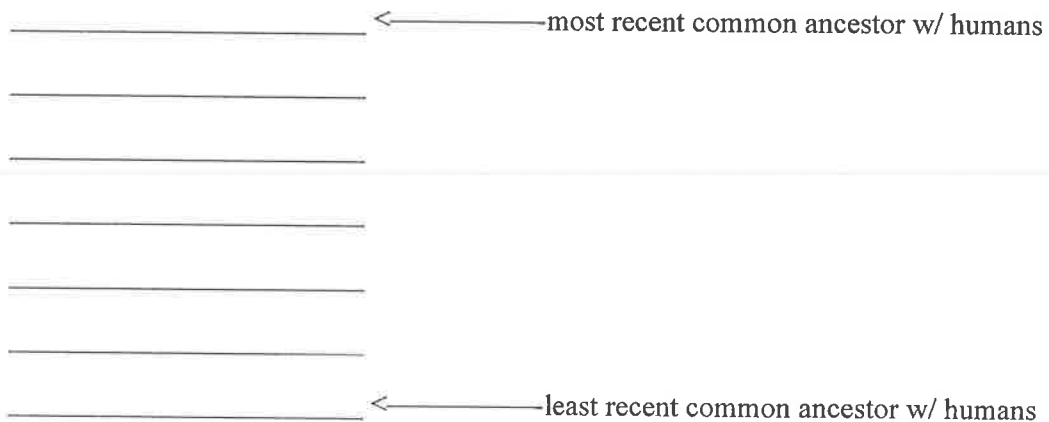


Figure 1. Amino acid sequence for one chain of hemoglobin in eight mammals. Each letter stands for a different amino acid.

	4	5	6	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Human	T	P	E	S	A	T	A	V	G	V	F	E	T	P	D	V	G	P	L	G	A	F	S	D	L	A	H	N	T	R	V	L	C	A	H	H	F	E	P	V	Y	N	V	L	C																																																		
Brown Bear	T	G	E	S	L	T	G	V	G	V	F	D	S	A	D	I	N	P	L	N	S	F	S	D	L	K	N	N	K	K	V	L	C	A	H	H	F	E	Q	V	Y	N	V	L	C																																																		
Chimpanzee	T	P	E	S	A	T	A	V	G	V	F	E	T	P	D	V	G	P	L	G	A	F	S	D	L	A	H	N	T	R	V	L	C	A	H	H	F	E	P	V	Y	N	V	L	C																																																		
Gibbon	T	P	E	S	A	T	A	V	G	V	F	E	T	P	D	V	G	P	L	G	A	F	S	D	L	A	H	N	Q	R	V	L	C	A	H	H	F	E	Q	V	Y	N	V	L	C																																																		
Gorilla	T	P	E	S	A	T	A	V	G	V	F	E	T	P	D	V	G	P	L	G	A	F	S	D	L	A	H	N	T	K	V	L	C	A	H	H	F	E	P	V	Y	N	V	L	C																																																		
Spider Monkey	T	P	E	N	A	T	T	V	G	L	F	E	S	P	D	V	G	P	L	G	A	F	S	D	L	N	H	N	Q	K	V	L	C	A	H	H	F	E	Q	V	Y	N	V	L	C																																																		
Mouse	T	D	A	A	A	S	C	S	G	V	Y	D	S	A	S	I	G	A	I	T	A	F	N	D	L	N	H	S	S	R	M	I	I	G	H	H	L	D	A	A	F	T	M	I	I																																																		
Shrew	S	G	E	A	C	T	G	E	A	V	F	D	S	A	S	V	G	P	L	H	S	L	G	E	V	A	N	N	K	R	V	L	V	A	S	K	F	E	P	V	F	N	V	L	V																																																		

7. Using complete sentences, explain what evidence you used to place the species in the order you did.

