

	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
Chimpanzee	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
	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
Chimpanzee	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

Figure 1

- In Data Table 1, notice that the abbreviated names of the amino acids in human hemoglobin are printed.
- In the appropriate spaces in Data Table 1, write the abbreviated name of each amino acid in chimpanzee hemoglobin that is *different from* that in human hemoglobin. If there are no differences, leave the spaces blank.
- For the remaining organisms, write the abbreviated names of the amino acids that do *not* correspond to those in human hemoglobin. **Note:** *Always be sure that you compare the amino acid sequence of each organism with that of the human and not the organism on the line above.*
- Use Figure 1 to complete Data Table 2.

Part B. Inferring Evolutionary Relationships from Differences in Amino Acid Sequences

- Another commonly studied protein is cytochrome *c*. This protein, consisting of 104 amino acids, is located in the mitochondria of cells. There it functions as a respiratory enzyme. Examine Figure 2. Using human cytochrome *c* as a standard, the amino acid differences between humans and a number of other organisms are shown.

Species Pairings	Number of Differences
Human–chimpanzee	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

Figure 2