

PLEASE WRITE / DRAW YOUR ANSWERS ON A SEPARATE SHEET OF PAPER 😊

1. Use the following data to construct a cladogram of the major plant groups.

Table 1: Characteristics of Major Plant Groups

Organism	Vascular Tissue	Flowers	Seeds
Mosses	0	0	0
Pine trees	1	0	1
Flowering plants	1	1	1
Ferns	1	0	0
Total	3	1	2

2. GAPDH (Glyceraldehyde 3-phosphate dehydrogenase) is an enzyme that catalyzes the sixth step in glycolysis, an important reaction that produces molecules used in cellular respiration. The following data table shows the percentage similarity of this gene and the protein it expresses in humans versus other species. For example, according to the table, the GAPDH gene in chimpanzees is 99.6% identical to the gene found in humans, while the protein is identical.

Table 2. Percentage Similarity Between the GAPDH Gene and Protein in Humans and Other Species

Species	Gene Percentage Similarity	Protein Percentage Similarity
Chimpanzee (<i>Pan troglodytes</i>)	99.6%	100%
Dog (<i>Canis lupus familiaris</i>)	91.3%	95.2%
Fruit fly (<i>Drosophila melanogaster</i>)	72.4%	76.7%
Roundworm (<i>Caenorhabditis elegans</i>)	68.2%	74.3%

- a. Why is the percentage similarity in the gene always lower than the percentage similarity in the protein for each of the species?
- b. In the space below, draw a cladogram depicting the evolutionary relationships among all five species (including humans) according to their percentage similarity in the GAPDH gene.

GULO gene BLAST results

<u>Species</u>	<u>Present or Absent?</u>	<u>Query cover</u>	<u>% identity / E-value</u>
Mouse (<i>Mus musculus</i>)	Present	100%	100 / 0.0
Dog (<i>Canis familiaris</i>)			
Cow (<i>Bos Taurus</i>)			
Pig (<i>Sus scrofa</i>)			
Guinea Pig (<i>Cavia porcellus</i>)			
Human (<i>Homo sapiens</i>)			
Chimp (<i>Pan troglodytes</i>)			

GULO Protein BLAST results

<u>Species</u>	<u>Present or Absent?</u>	<u>E value</u>	<u>Query cover</u>	<u>% identity</u>
Mouse (<i>Mus musculus</i>)	Present	0.0		
Dog (<i>Bos taurus</i>)				
Pig (<i>Sus scrofa</i>)				
Cow (<i>Bos Taurus</i>)				
Guinea Pig (<i>Cavia porcellus</i>)				
Human (<i>Homo sapiens</i>)				
Chimp (<i>Pan troglodytes</i>)				