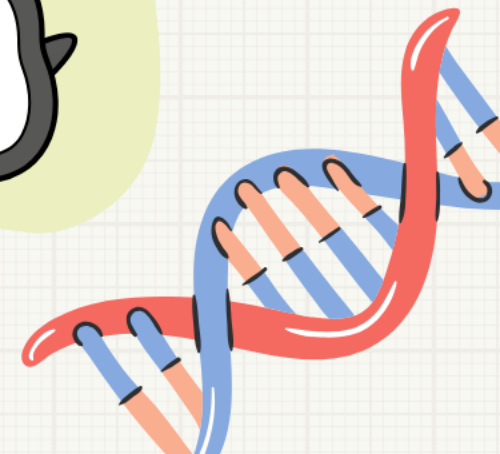
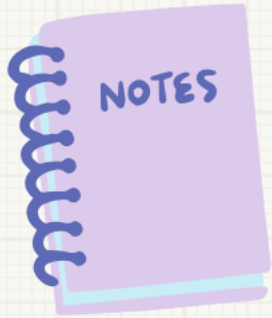


# AP Bio FRQ Fridays

2019 #5  
Cladograms



# FRQ Friday #21

2019 #5

A researcher studying the evolutionary relationship among five primate species obtained data from a sequence of mitochondrial DNA (mtDNA) from a representative individual of each species. The researcher then calculated the percent divergence in the sequences between each pair of primate species (Table 1).

TABLE 1. DIVERGENCE (IN PERCENT) OF MITOCHONDRIAL DNA SEQUENCES AMONG FIVE PRIMATE SPECIES

	Human	Gorilla	Orangutan	Gibbon	Chimpanzee
Human	-	10.3	16.1	18.1	8.8
Gorilla		-	16.7	18.9	10.6
Orangutan			-	18.9	17.2
Gibbon				-	18.9
Chimpanzee					-



# FRQ Friday #21

2019 #5

(a) Based on fossil data, the researcher estimates that humans and their most closely related species in the data set diverged approximately seven million years ago. Using these data, **calculate** the rate of mtDNA percent divergence per million years between humans and their most closely related species in the data set. Round your answer to two decimal places.

$$\frac{8.8}{7} = 1.257$$

Calculation (1 point)

- 1.25 OR 1.26

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9. The rate of mtDNA percent divergence per million years is ≈ 1.26 per million years.



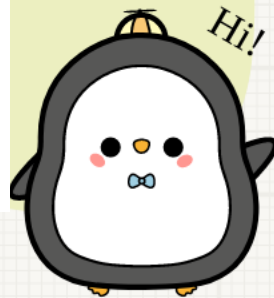
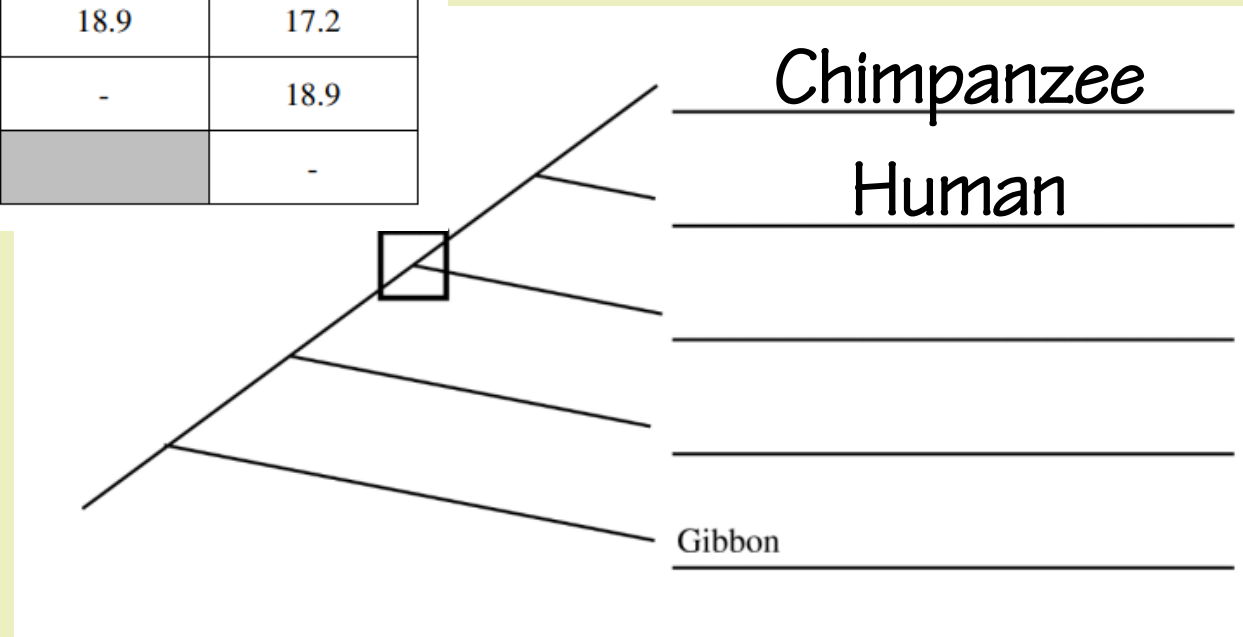
# FRQ Friday #21

2019 #5

(b) Using the data in the table, **construct** a cladogram on the template provided. **Provide reasoning** for the placement of gibbons as the outgroup on the cladogram.

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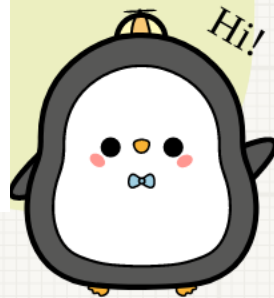
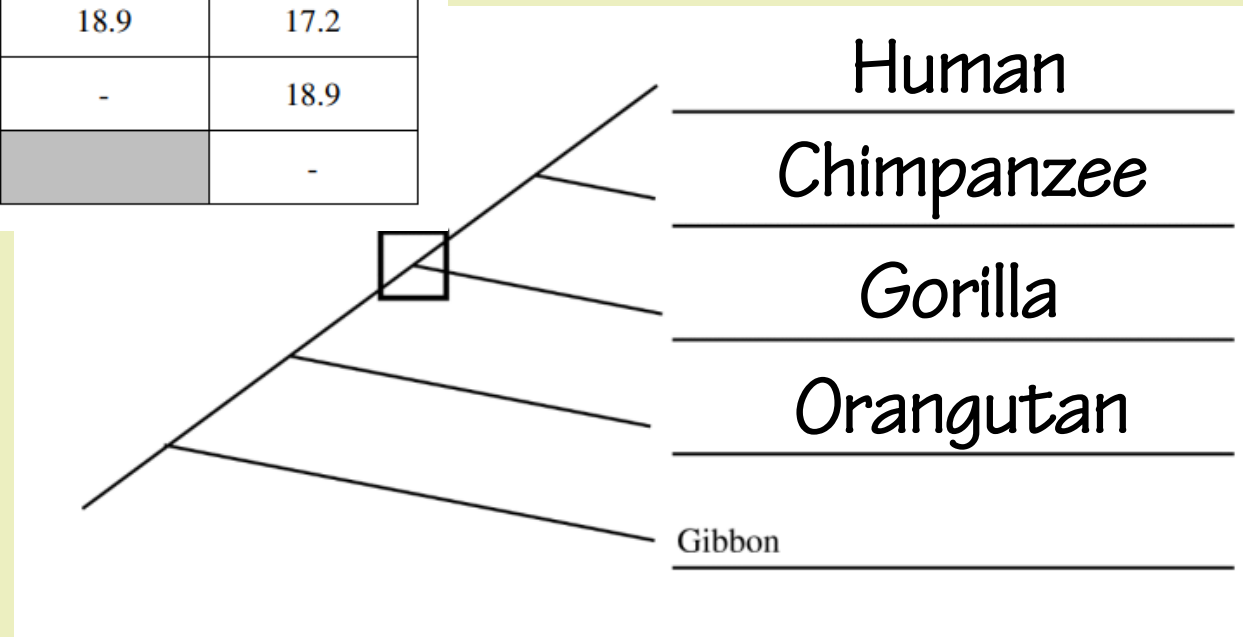
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# FRQ Friday #21

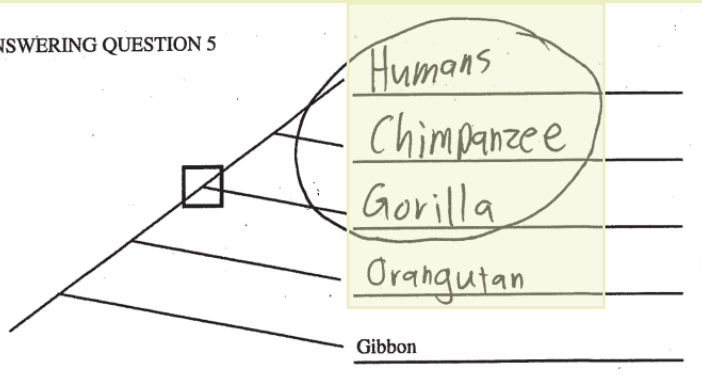
2019 #5

(b) Using the data in the table, **construct** a cladogram on the template provided. **Provide reasoning** for the placement of gibbons as the outgroup on the cladogram.

## Reasoning (1 point)

- Gibbon mtDNA is the least similar (to all of the other species)/most different (from all of the other species).
- Gibbon mtDNA is the most divergent (from all of the other species).

ANSWERING QUESTION 5



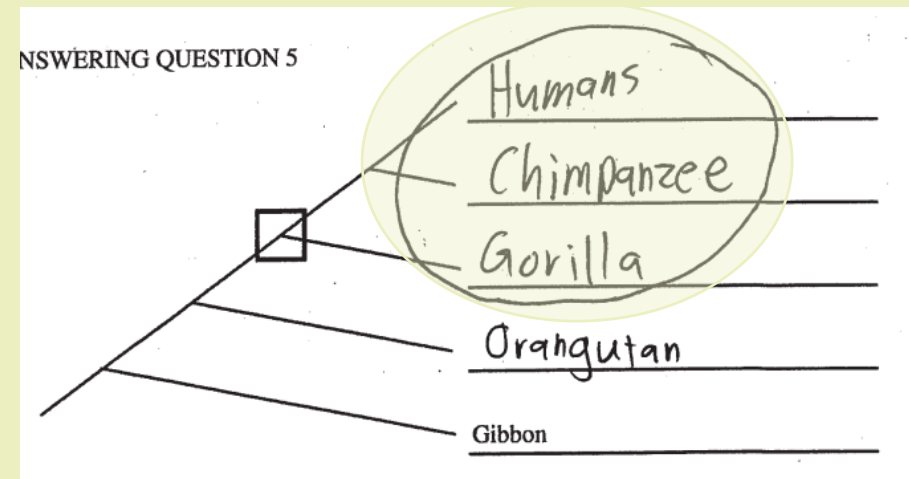
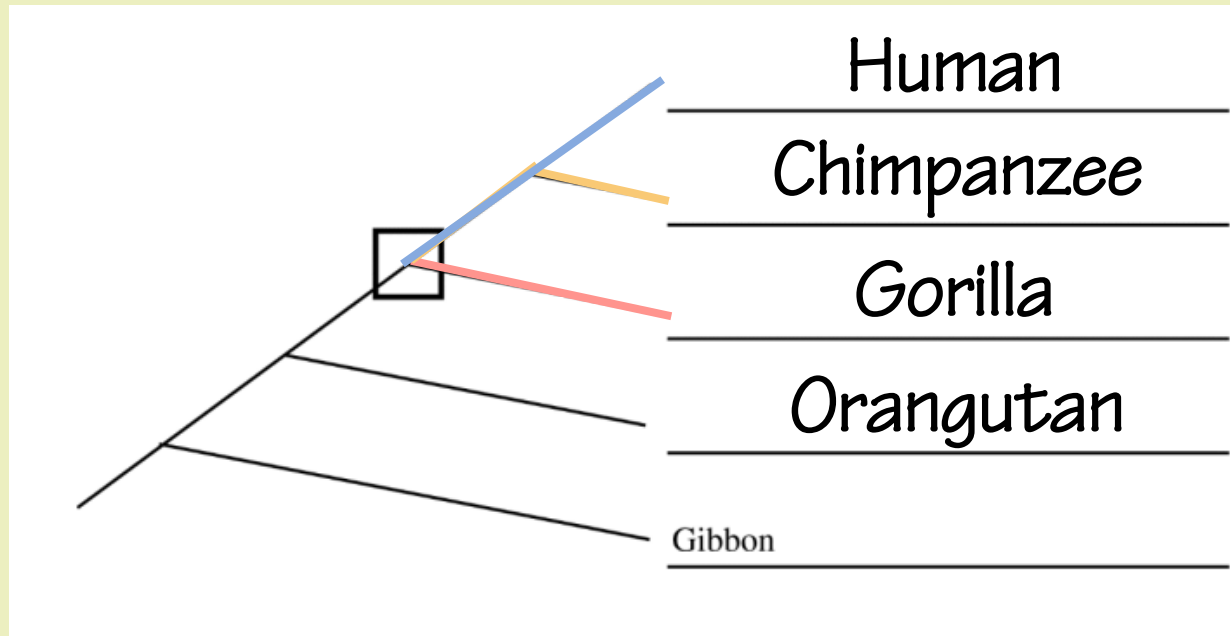
b. Gibbons are the outgroup on the cladogram because it has the greatest/largest divergence of mitochondrial DNA among the 5 primate species.



# FRQ Friday #21

2019 #5

(c) On the cladogram, **draw** a circle around all of the species that are descended from the species indicated by the node within the square.



**Circle (1 point)**

- Circle species 1, 2, and 3, as numbered from the top.

