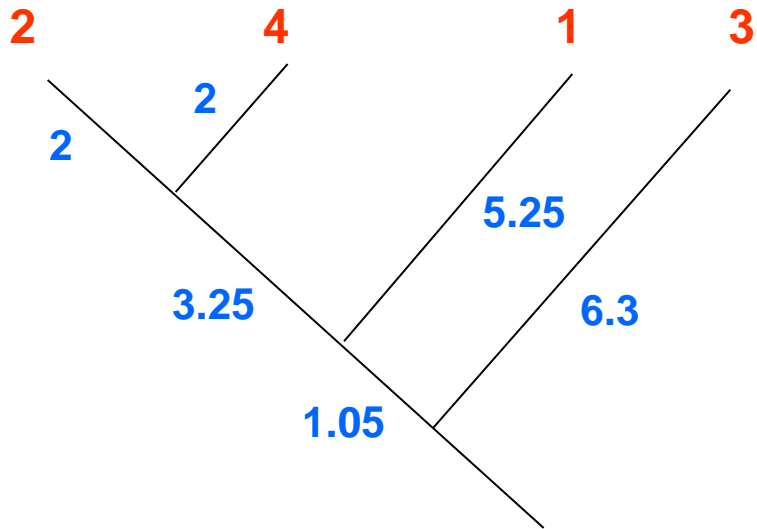
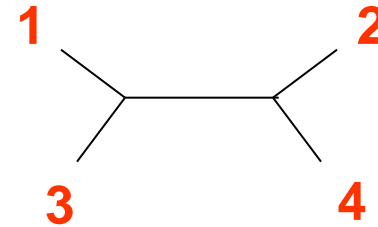


## Practice question #1

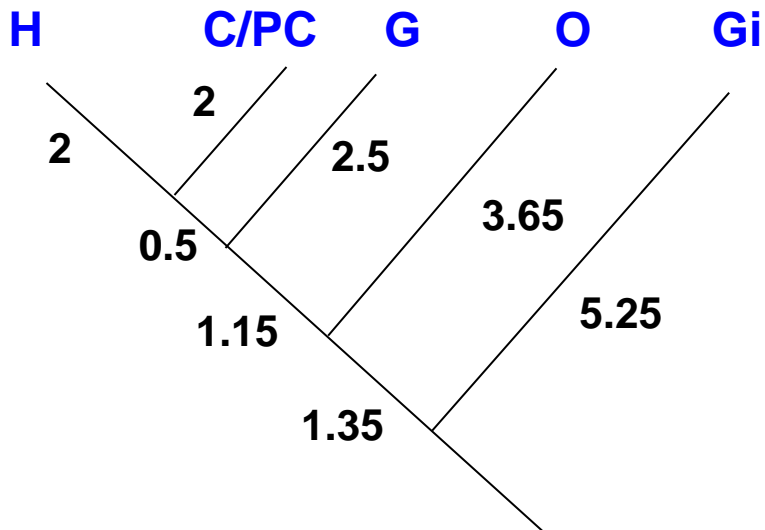
UPGMA tree:



Favoured maximum parsimony tree:



## Practice question #2

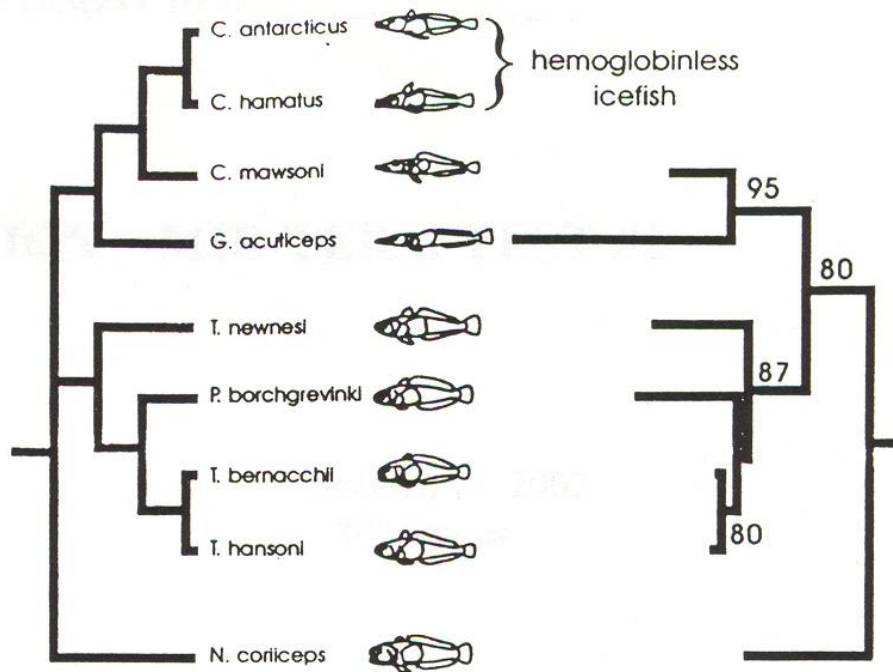


## Practice question #3



[www.icefish.neu.edu/photo/](http://www.icefish.neu.edu/photo/)

"Are red blood cells really necessary? ... a fish species that lives without them"



Species tree

Gene tree

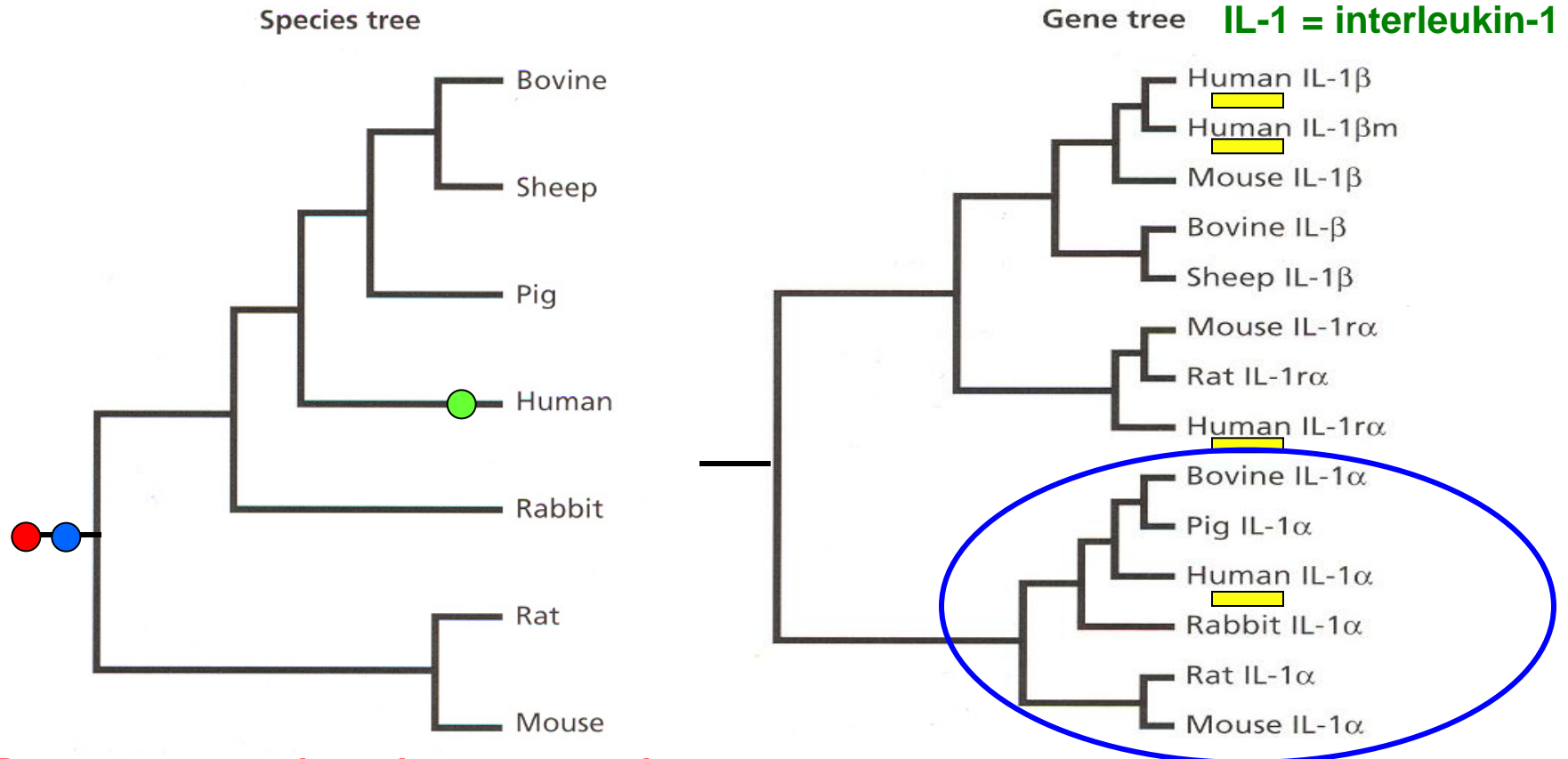
(using hemoglobin sequences)

Do the 2 trees show the same topology?

Implications of differences in branch lengths on gene tree?

Long branches: reduced functional constraint? or evolving new function (adaptive evolution)?

## Practice question #4



Does gene tree show the same topology as the species tree? (eg. for IL-1 $\alpha$  clade)

How many copies of IL-1 gene?

When did duplication events occur?

Certain copies of genes lost from specific lineages vs. incomplete data sets for some organisms?

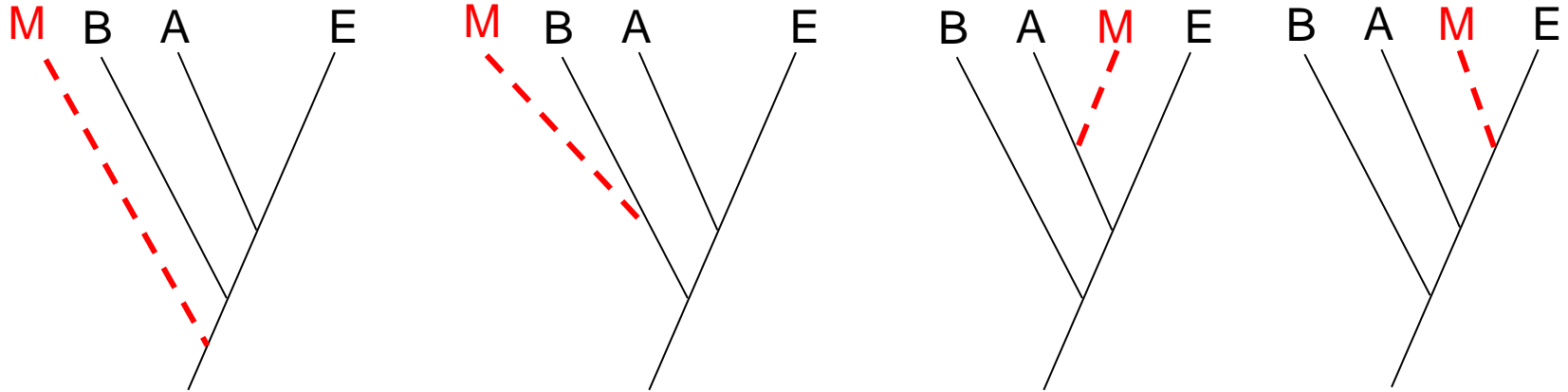
Clade has same topology as species tree, so IL-1 $\alpha$  type gene present in common ancestor & accumulating nt subs in predicted manner

- 4 in human genome so at least 3 duplication events – predict two in common ancestor & one in human-specific lineage

sheep lacking IL-1 $\alpha$  gene or incomplete data set

## Question #5

Possible scenarios



- choose well-characterized **highly-conserved gene** from M to compare with homologues from bacteria, archaea & eukaryotes