

The Origins Of The Eukaryotic Cell

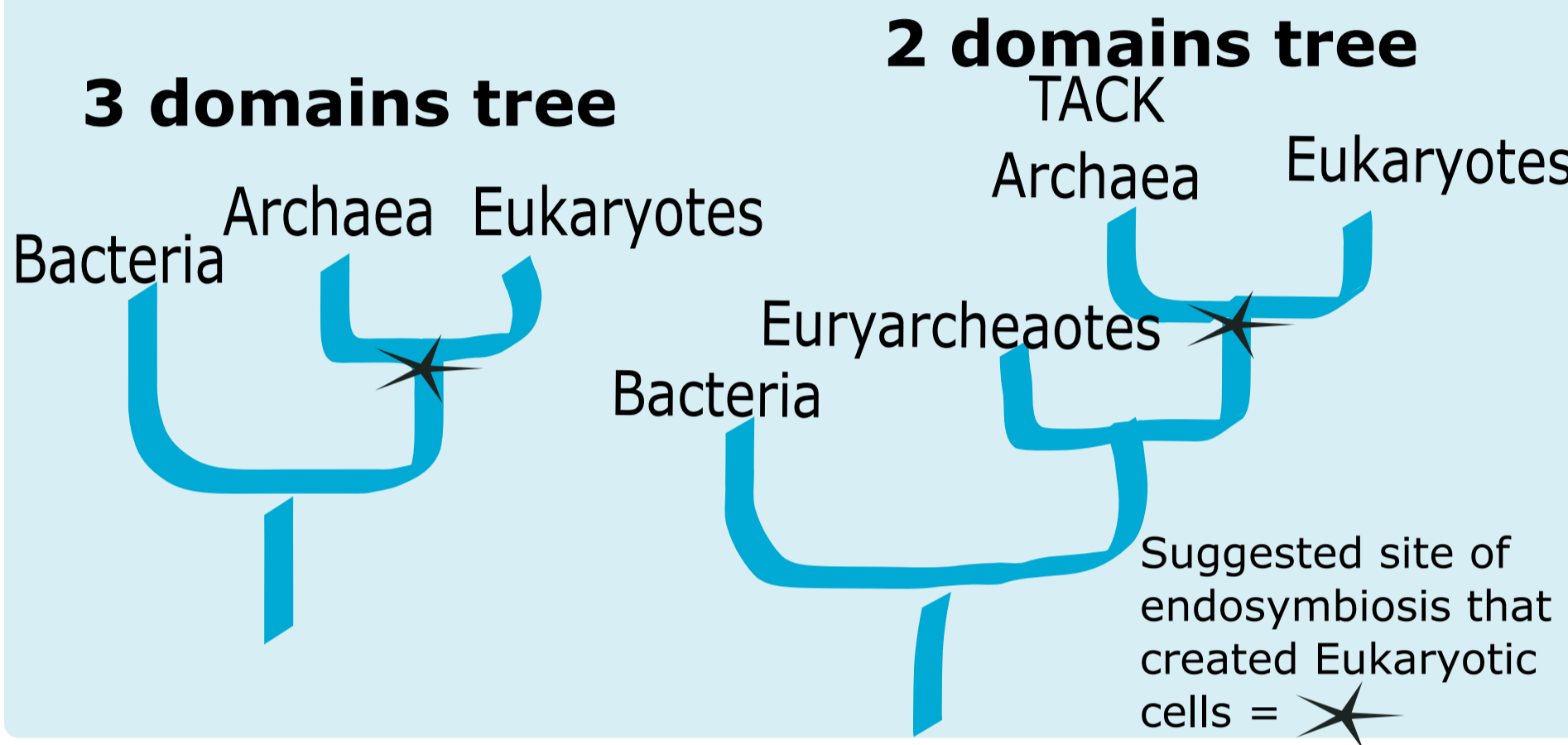
Investigating the origins of the host for the mitochondrial endosymbiont

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Background

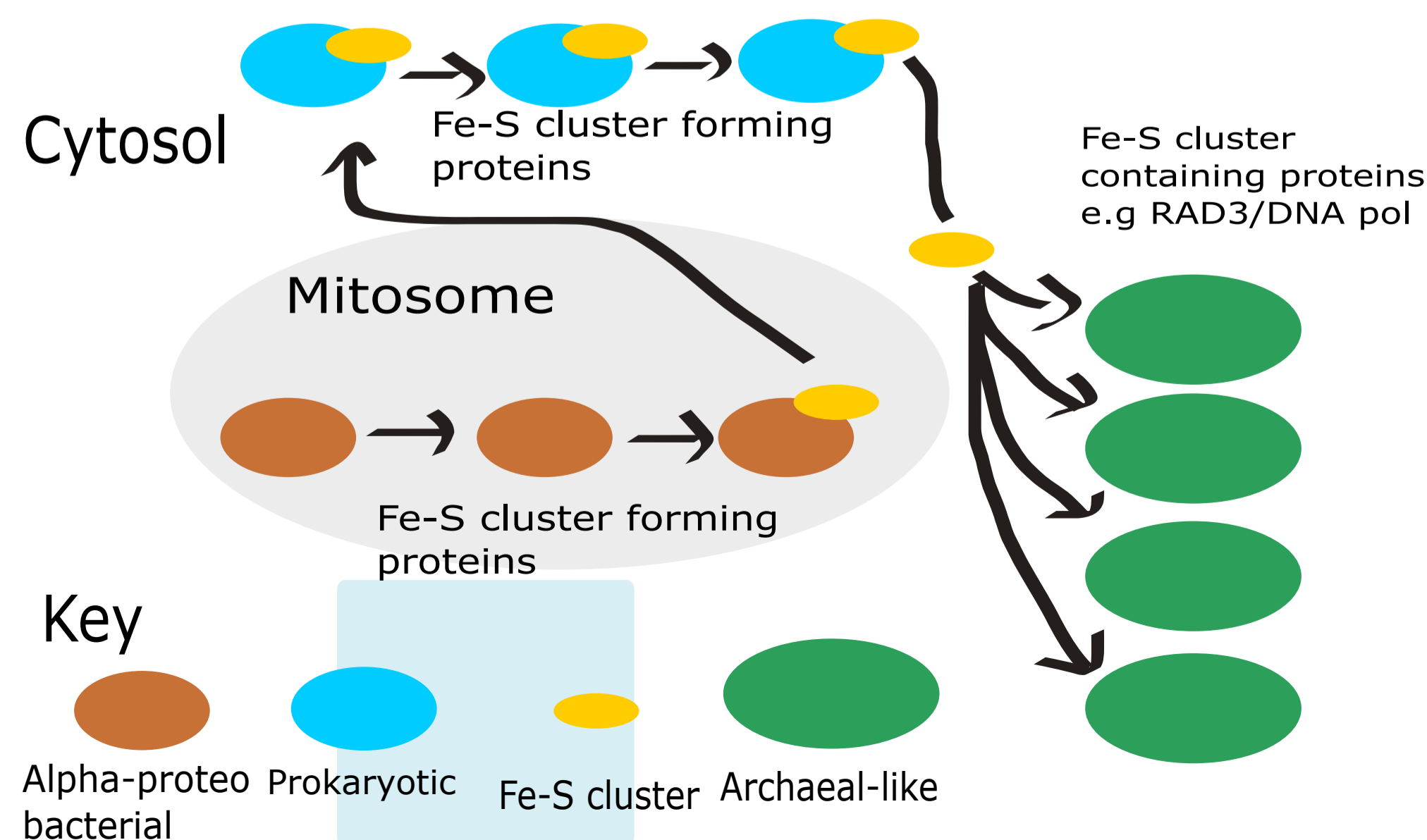
- There are three proposed primary domains of life: Eukaryotes, Bacteria and Archaea
- Eukaryotes were formed by the endosymbiosis of an alpha-proteo bacteria in an Archaea-like host
- The origin of Eukaryotes is unresolved, differing opinions lead to two hypotheses:



Aim of my project

- To investigate the potential host for the endosymbiosis by comparing the sequences of highly conserved Fe-S containing proteins, and analysing their relationships to one another.
- To explore whether the addition of newly sequenced Archaea can help to resolve the origin of the host.

Fe-S cluster pathway

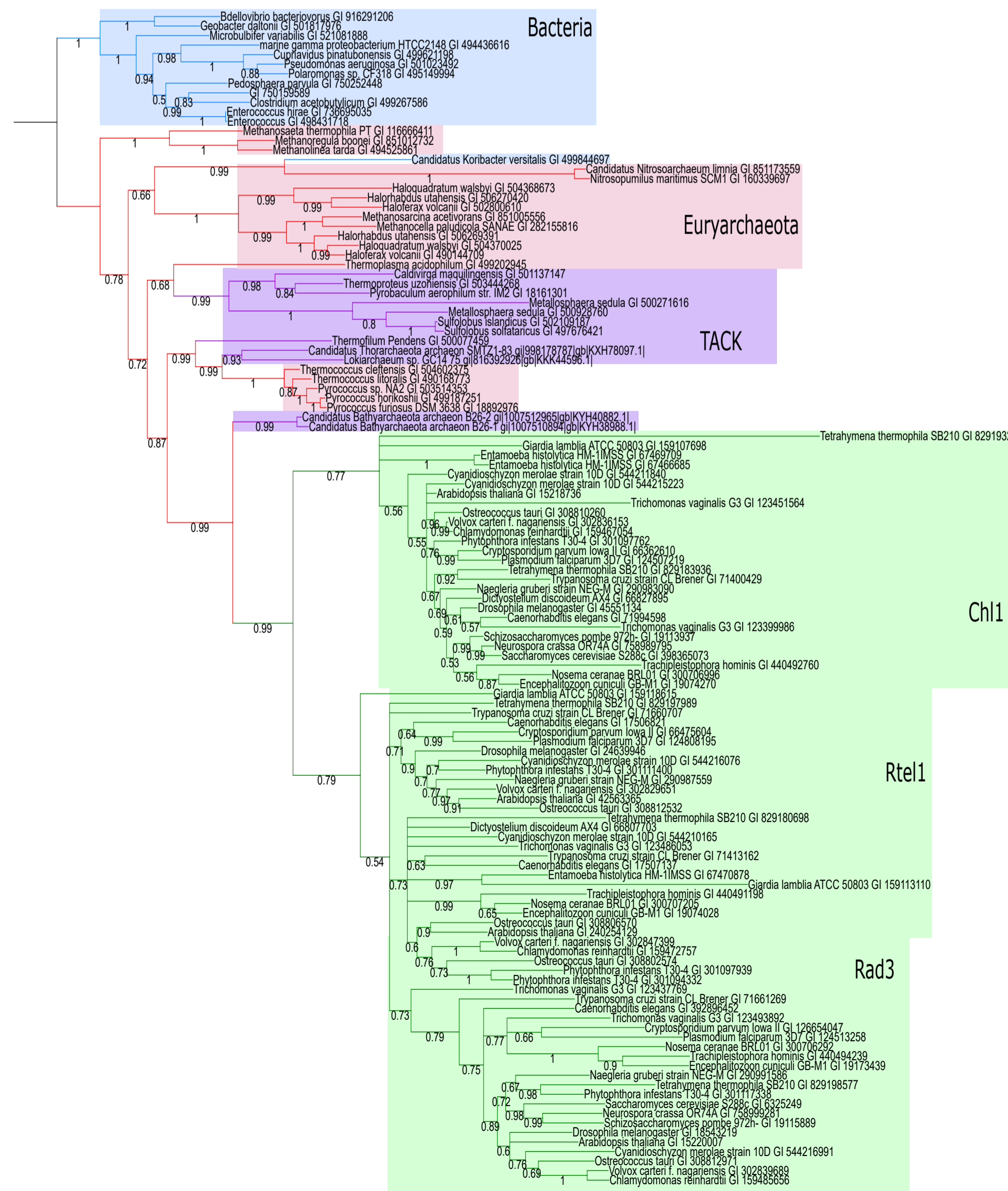


Model fit

- The models used to compare molecular sequences do not always accurately reflect the complexity of the dataset
- After comparing multiple models, the trees shown here were constructed using models that best fit the data with regards to mutation saturation

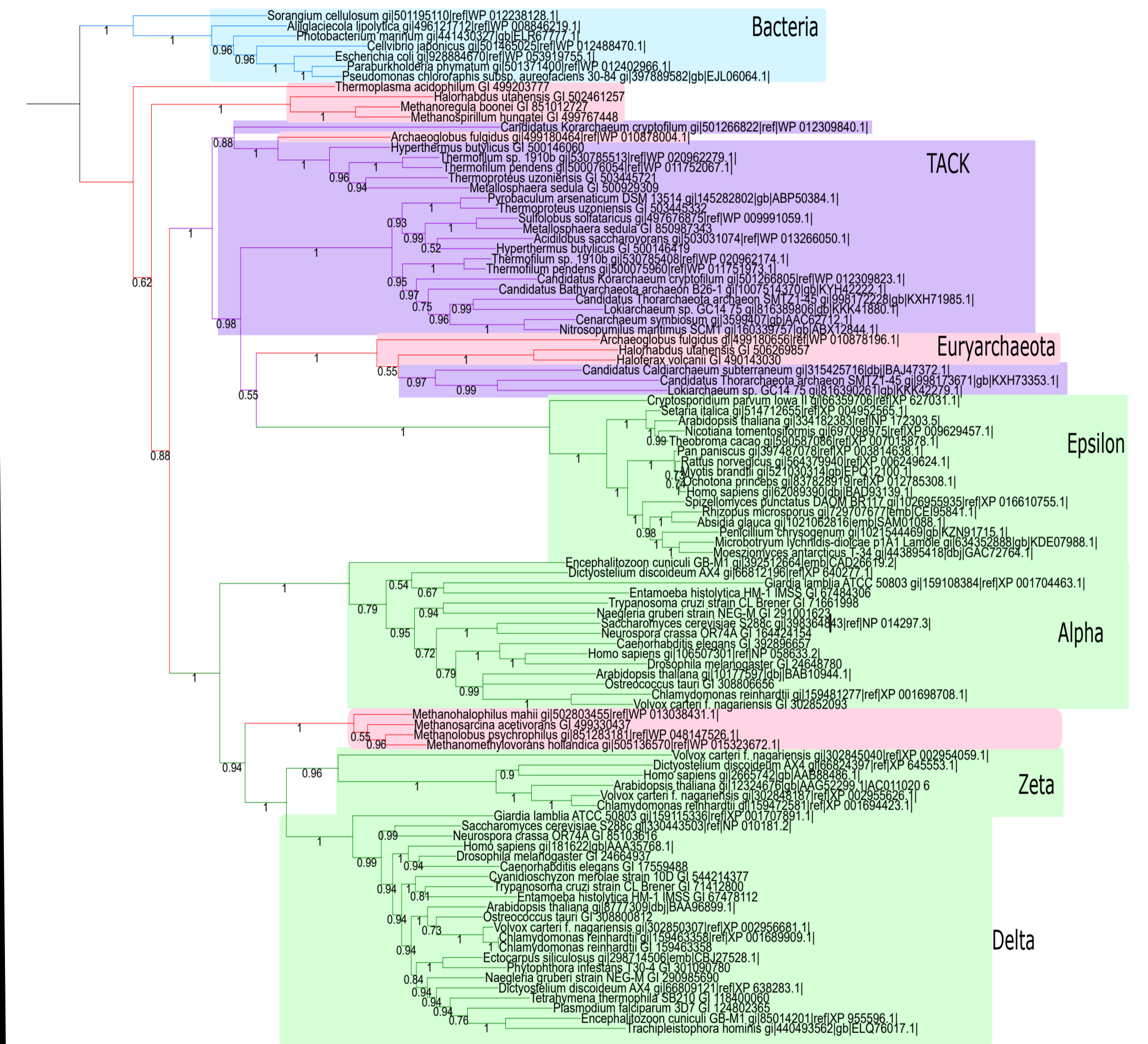
RAD3 tree

- RAD3 is a DNA helicase conserved in all 3 domains
- In all models used, newly sequenced Candidatus Bathyarchaeota (TACK member) is identified as a sister group to eukaryotes
- Support for this increases with better models
- This tree is more consistent with two domains hypothesis



B family DNA polymerase tree

- B family DNA polymerases are the main polymerases in nuclear DNA replication
- The epsilon subunit emerges from within a TACK dominated clade
- Other subunits are sister groups to this TACK clade, with some Euryarchaeotes emerging from within them.
- This is similar to Tahirov¹ which suggested epsilon has a different origin to the other subunits.



Conclusion

- The phylogenies created using Fe-S cluster containing proteins show topologies that are more consistent with the 2 domains tree
- With new Archaea, support for this increases
- To improve result, larger sampling and better models should be used

Acknowledgments and references

- Institute for Cell and Molecular Biosciences; Embley/Hirt lab M2.041
- Newcastle University Research Scholarships
- 1. Tahirov, Tahir H et al. "Evolution Of DNA Polymerases: An Inactivated Polymerase-Exonuclease Module In Pol E And A Chimeric Origin Of Eukaryotic Polymerases From Two Classes Of Archaeal Ancestors". Biology Direct 4.1 (2009)