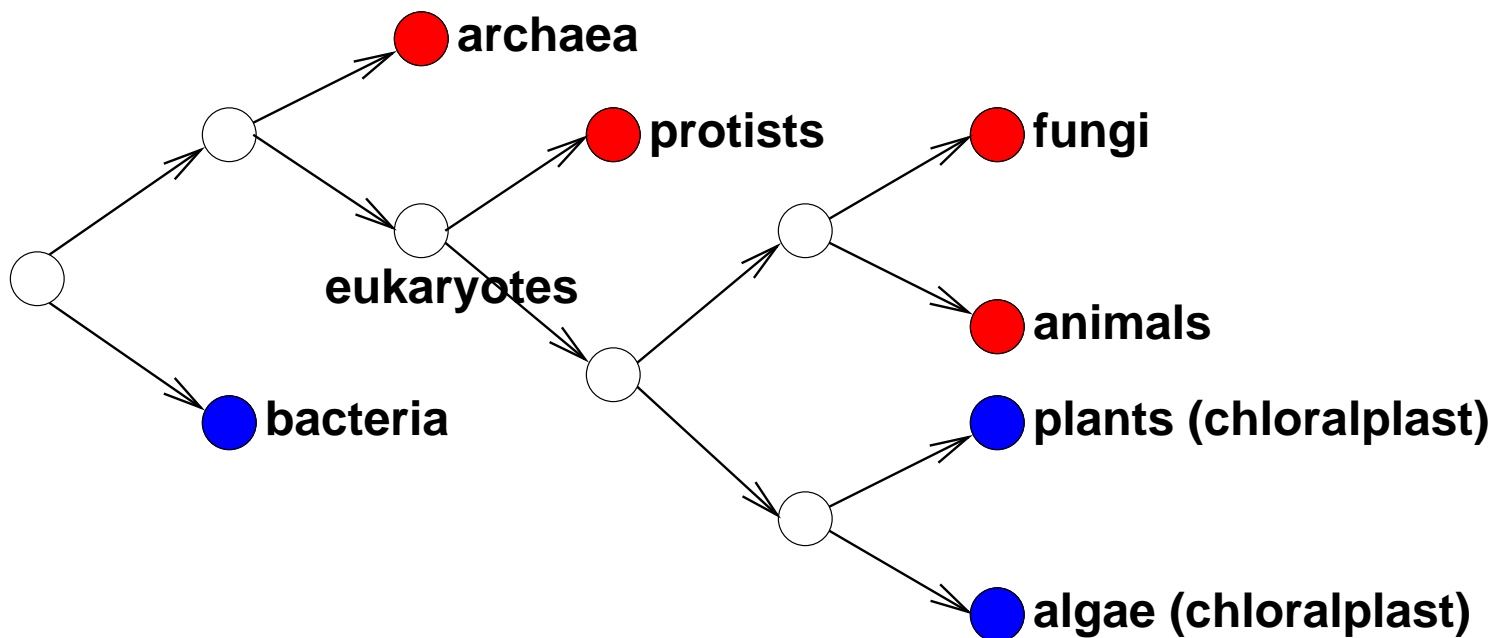


Covariation due to the mismatch of gene tree and species tree

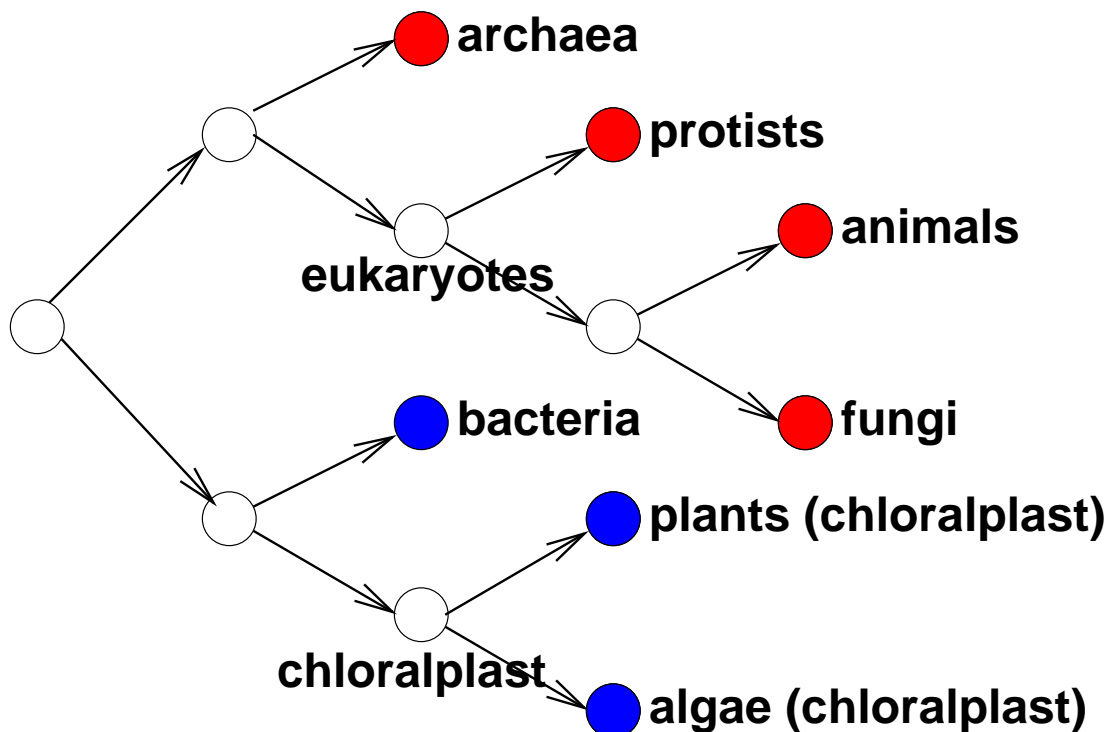


sequence evolution on species tree.

sequence pair 1 (blue) appears in bacteria, plants and algae.

sequence pair 2 (red) appears in archaea, non-green eukaryote.

transition between 1 and 2 occurs twice.



sequence evolution on gene tree.

sequence pair 1 (blue) appears in bacteria and chloroplast.

sequence pair 2 (red) appears in eukaryotes and archaea.

transition between 1 and 2 occurs once.