

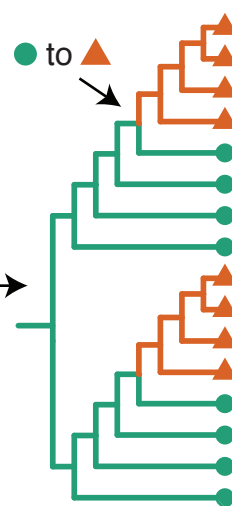
Lineage tree with trait values at tips

Maximum parsimony trait reconstruction

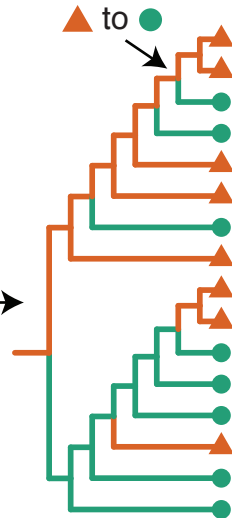
Compare observed and randomized SP statistics to calculate p value

Germline

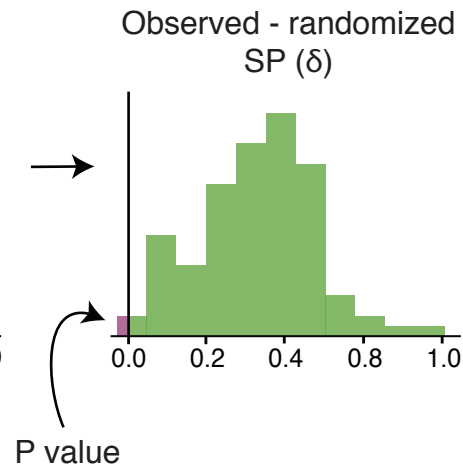
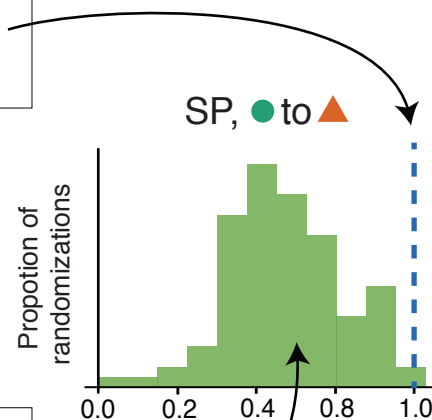
Randomize traits



Observed tree statistics		Switch proportion (SP)
State changes		
● to ▲	2	1.0
▲ to ●	0	0.0



Randomized tree statistics		Switch proportion (SP)
State changes		
● to ▲	2	0.33
▲ to ●	4	0.67



Repeat for 1000 randomizations, plot distribution

$P < 0.05$ indicates the tree has a significantly greater proportion of switches from ● to ▲ than expected from randomized trees