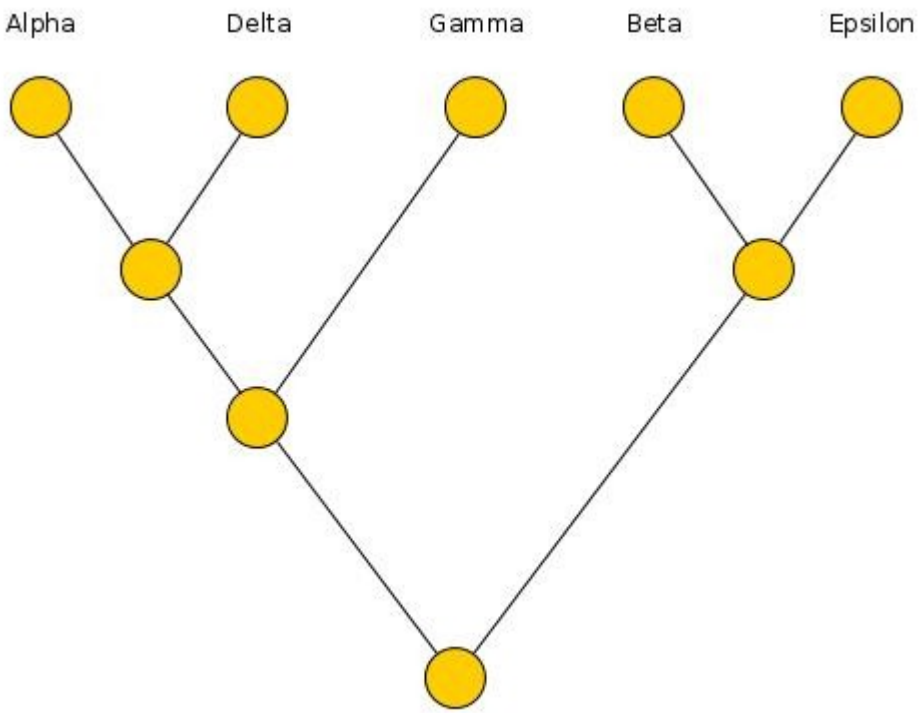
Parsimony: character data

- Small Phylogeny Problem (SPP):
  - Given a phylogeny, reconstruct events minimizing amount of evolution
- Big Phylogeny Problem (BPP):
  - Search, among all phylogenies, the ones with minimum evolution

Small example

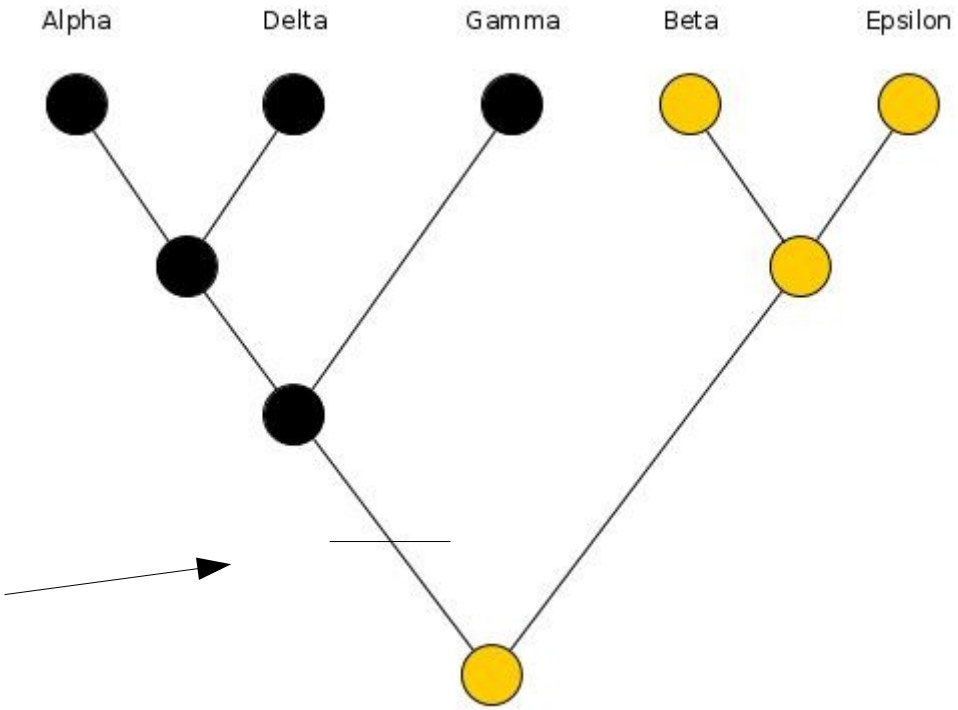
	Characters					
Species	C1	C2	C3	C4	C5	C6
Alpha	1	0	0	1	1	0
Beta	0	0	1	0	0	0
Gamma	1	1	0	0	0	0
Delta	1	1	0	1	1	1
Epsilon	0	0	1	1	1	0

Possible phylogeny



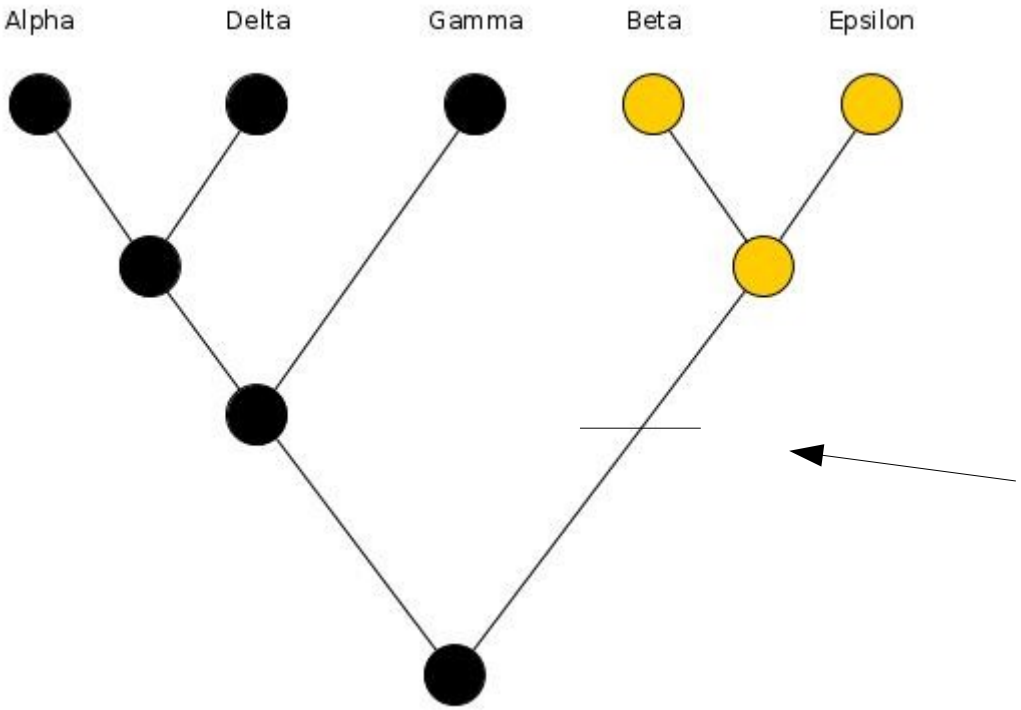
Reconstruction of C1 (1)

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



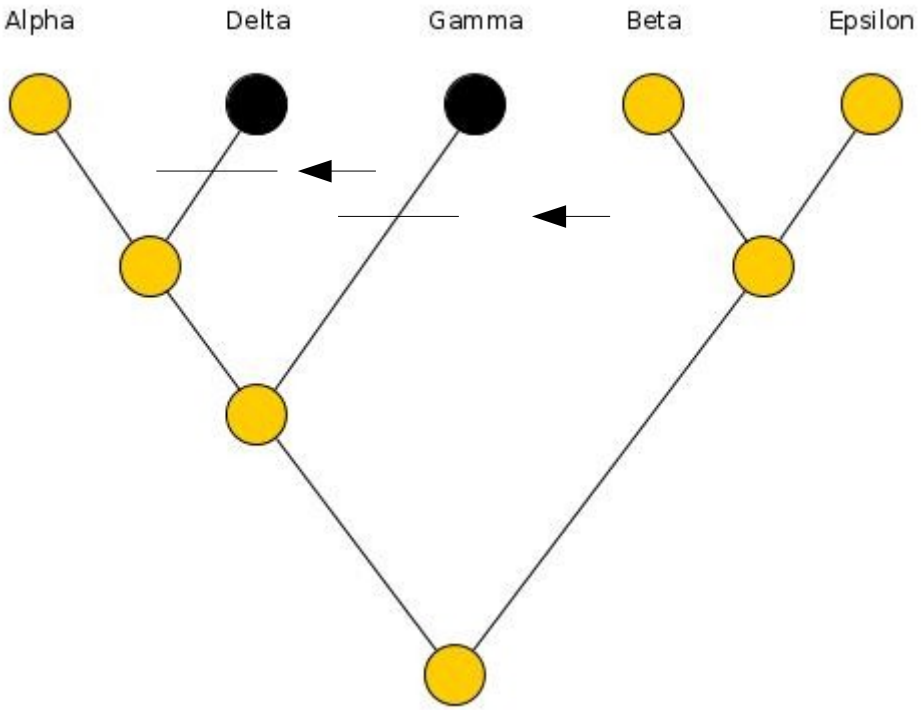
Reconstruction of C1 (2)

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



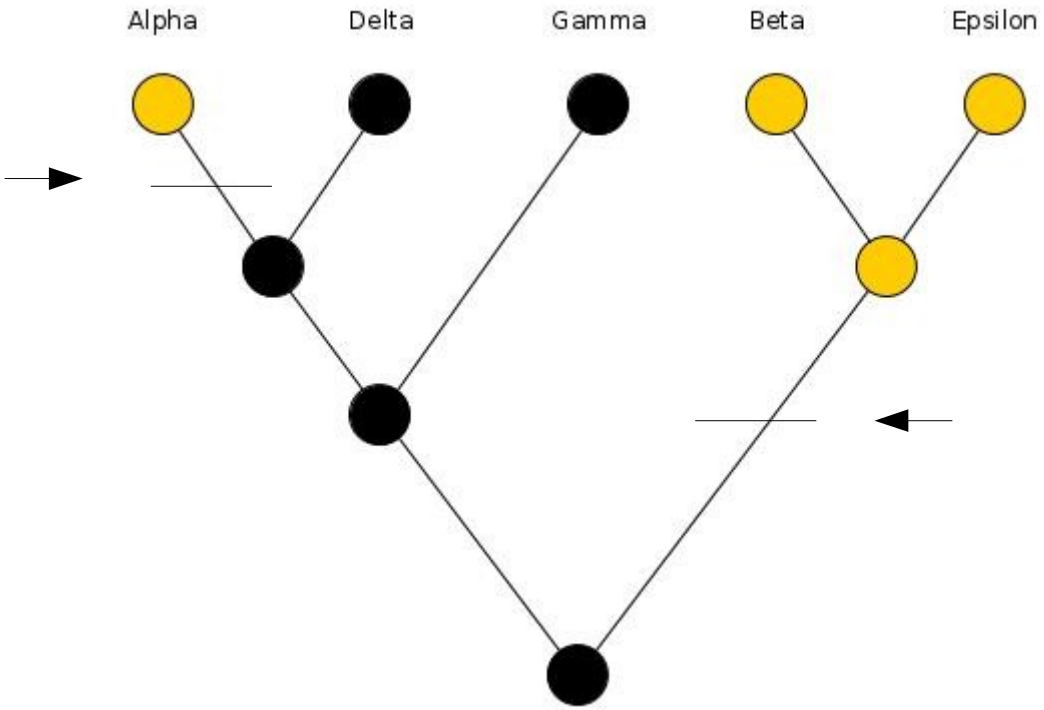
Reconstruction of C2 (1)

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



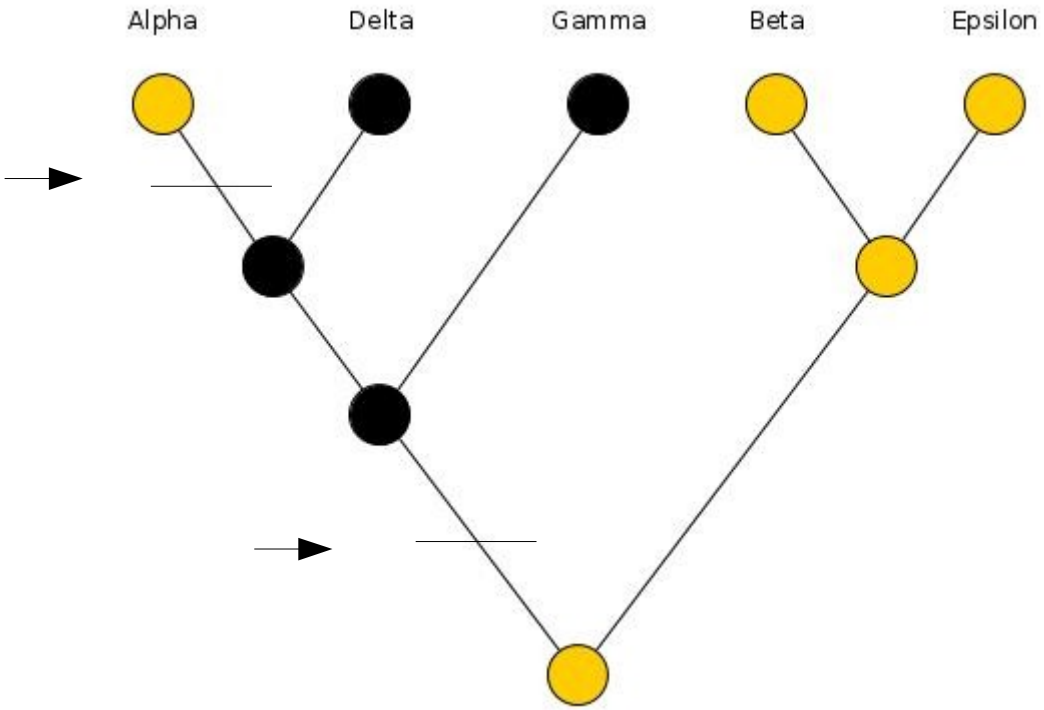
Reconstruction of C2 (2)

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



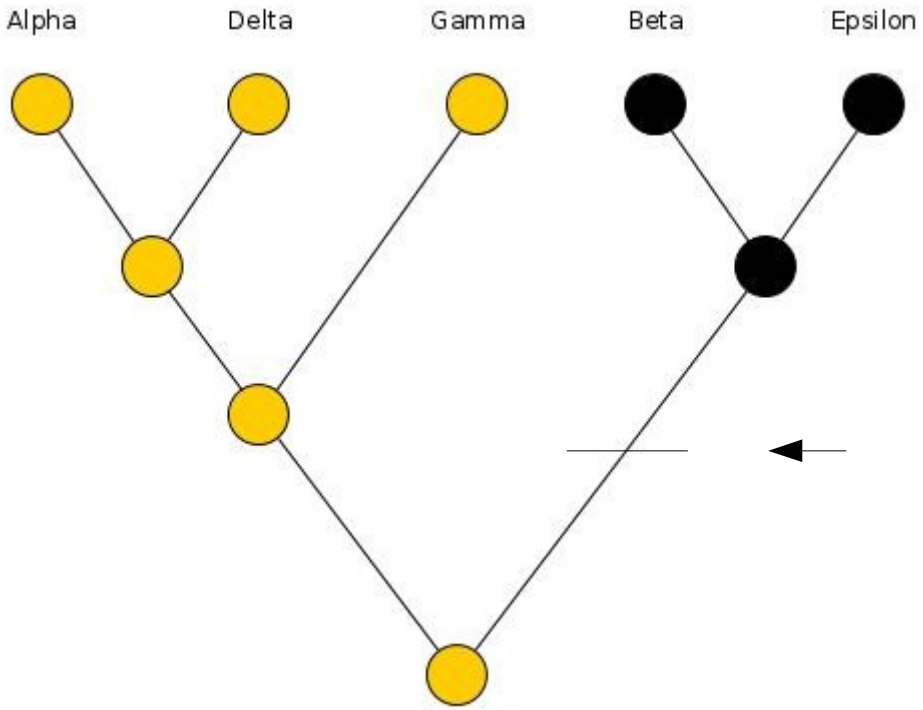
Reconstruction of C2 (3)

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



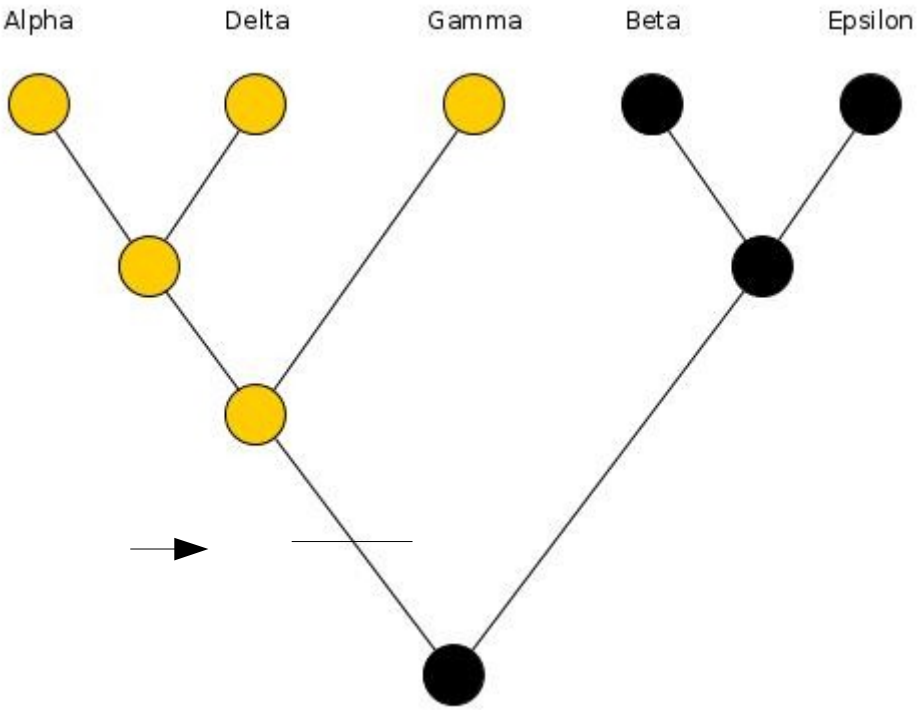
Reconstruction of C3 (1)

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



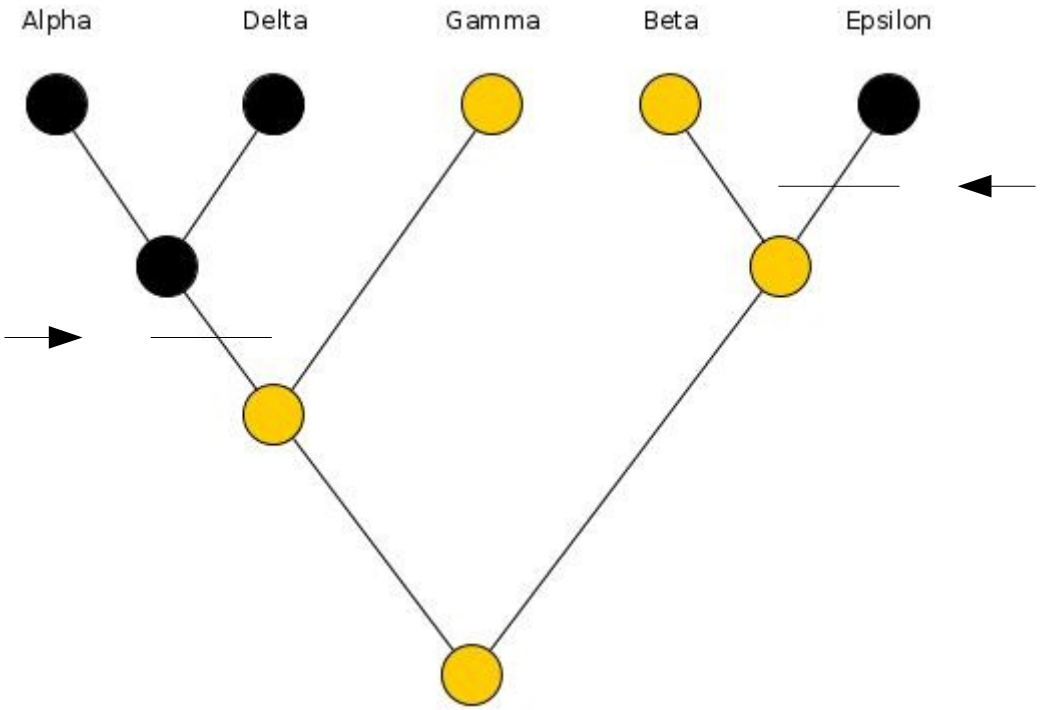
Reconstruction of C3 (2)

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



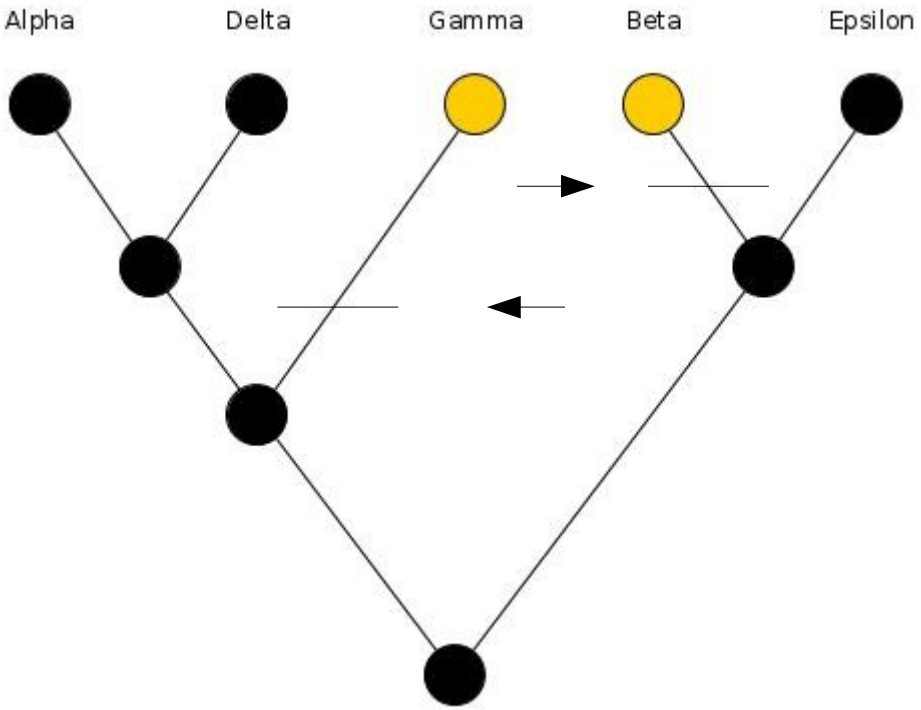
Reconstruction of C4 (1)

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



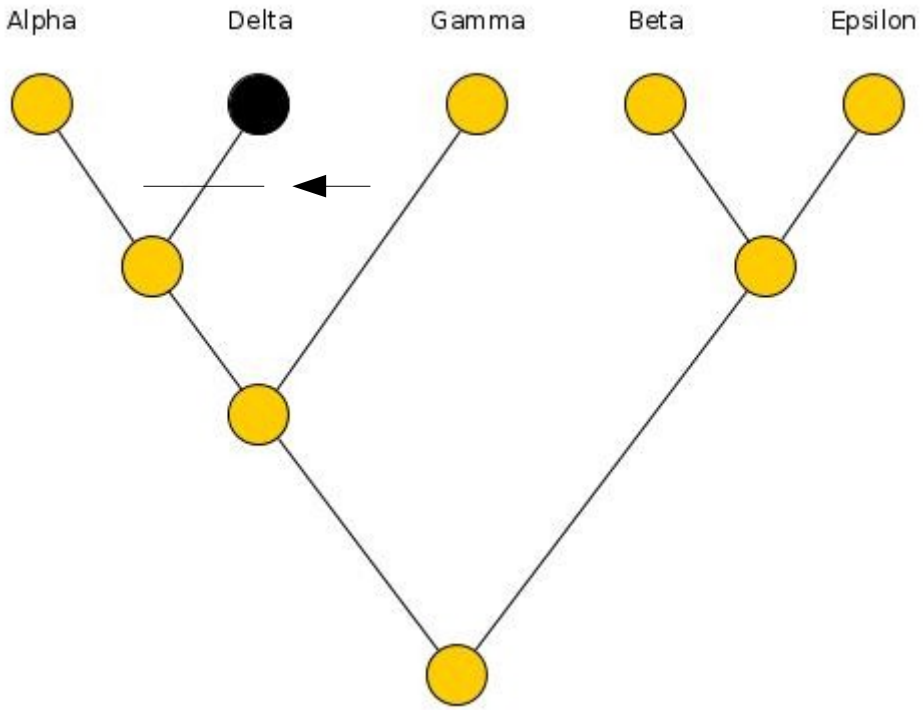
Reconstruction of C4 (2)

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



Reconstruction of C6 (1)

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0

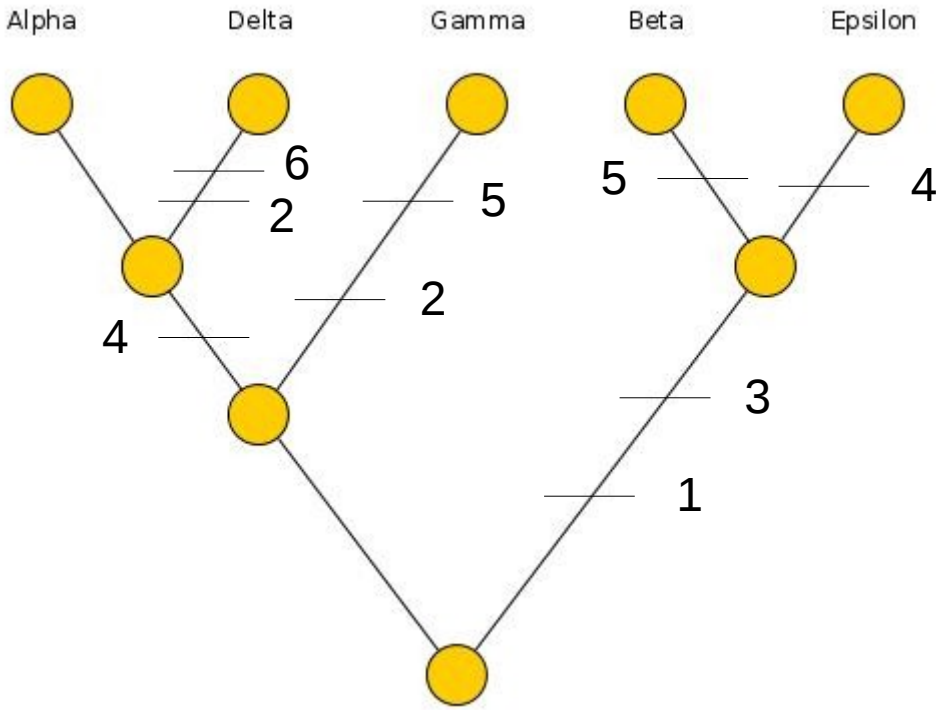


Parsimony

- Several ways of minimizing each character
- Equivalent characters
  - Same vector
  - Same changes
- Complementary characters:
  - Same changes

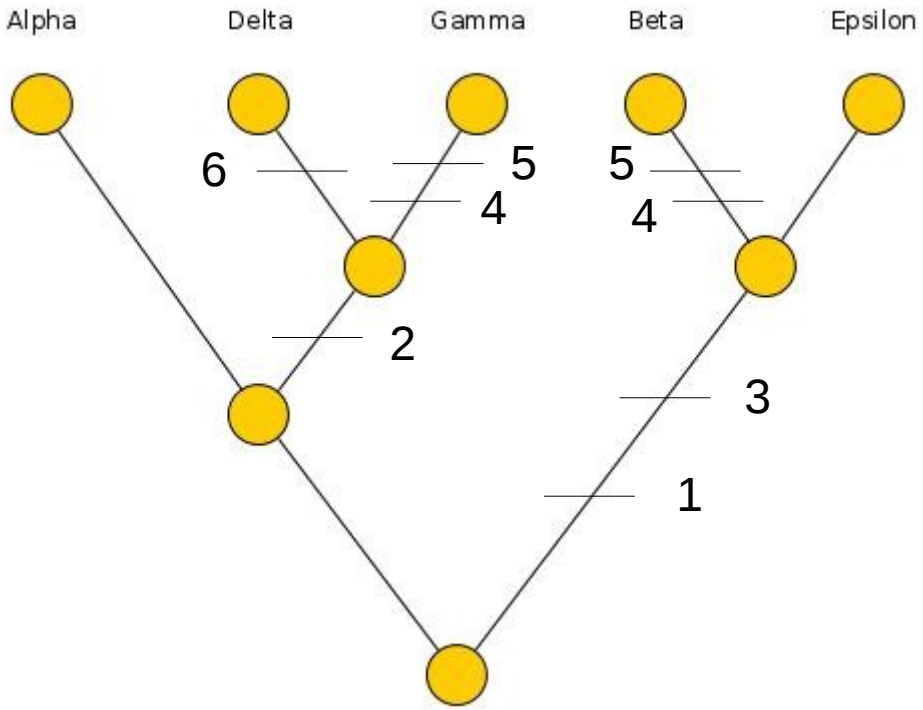
All characters

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



Most parsimonious tree

	C1	C2	C3	C4	C5	C6
A	1	0	0	1	1	0
B	0	0	1	0	0	0
G	1	1	0	0	0	0
D	1	1	0	1	1	1
E	0	0	1	1	1	0



Parsimony

- Rooted and unrooted trees
  - Number of changes depends only on the unrooted tree when changes are symmetric
- Rooting a tree
  - Outgroup
  - Molecular clock
- Branch length
  - Amount of change (or evolution)

Parsimony issues

- Given a topology and a character (SPP):
  - Minimize number of changes
  - Reconstruct ancestor states
- Most parsimonious among all trees (BPP)
- DNA or protein sequences, other characters
- Biological basis for parsimony
- Statistical support for most parsimonious tree