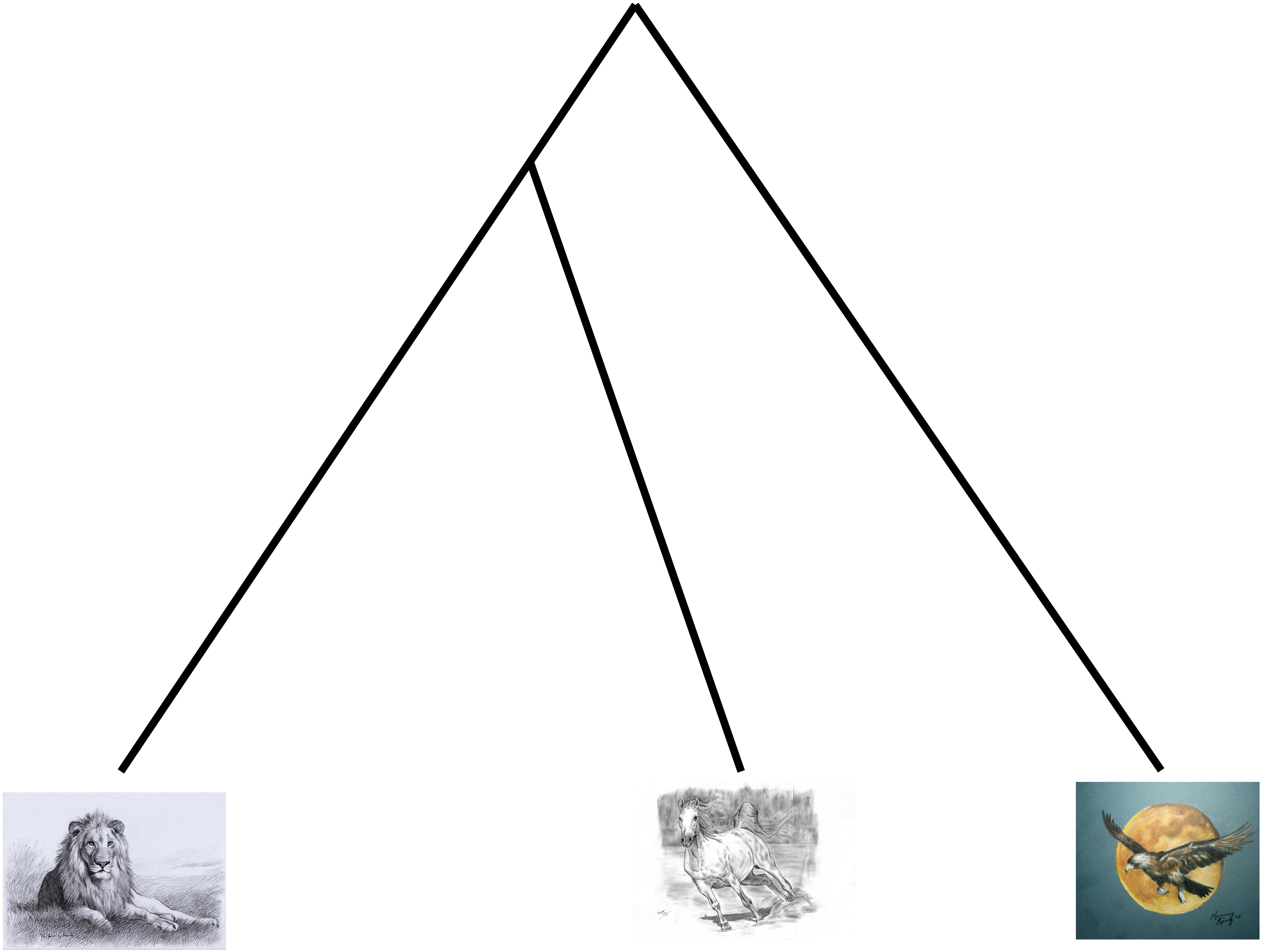
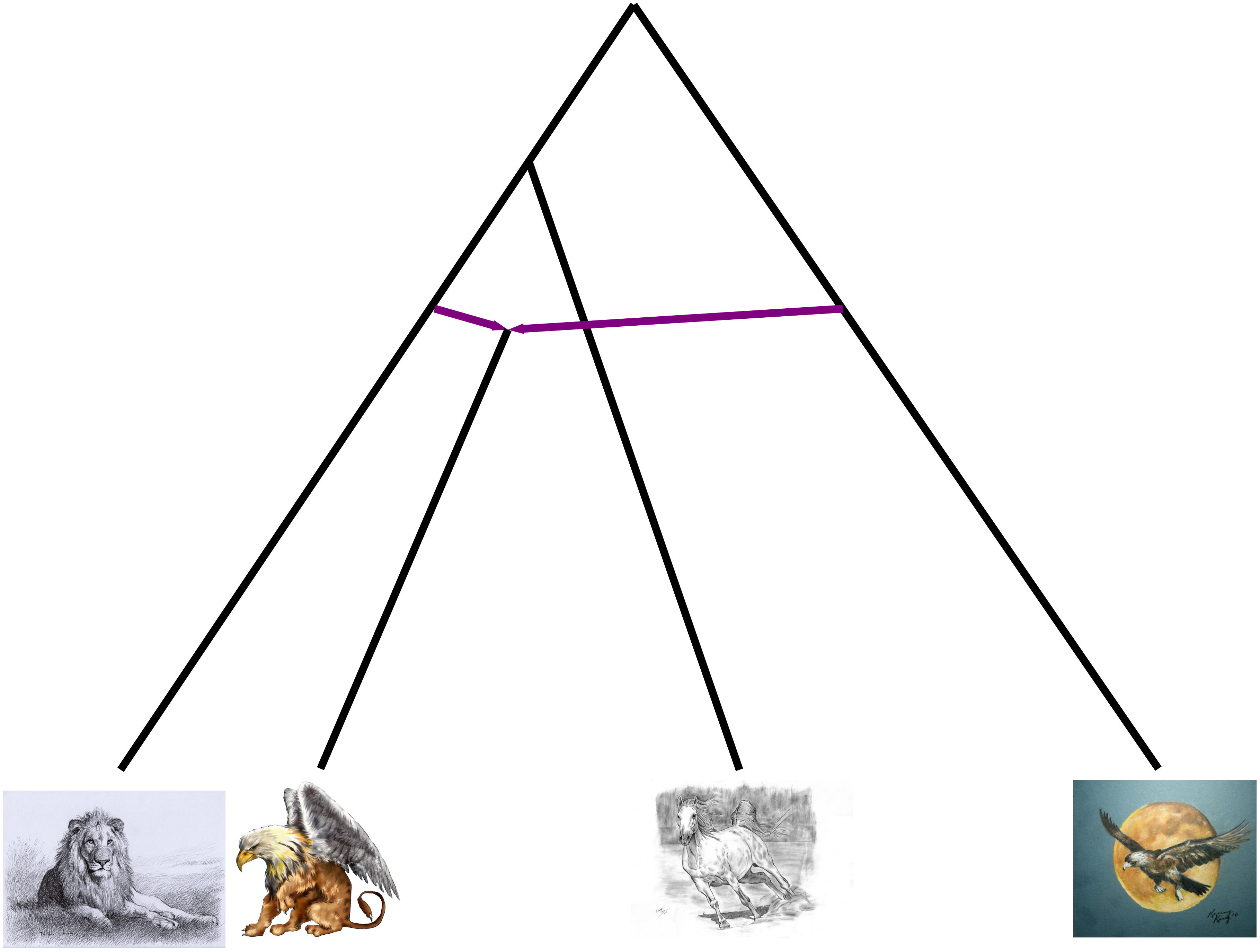
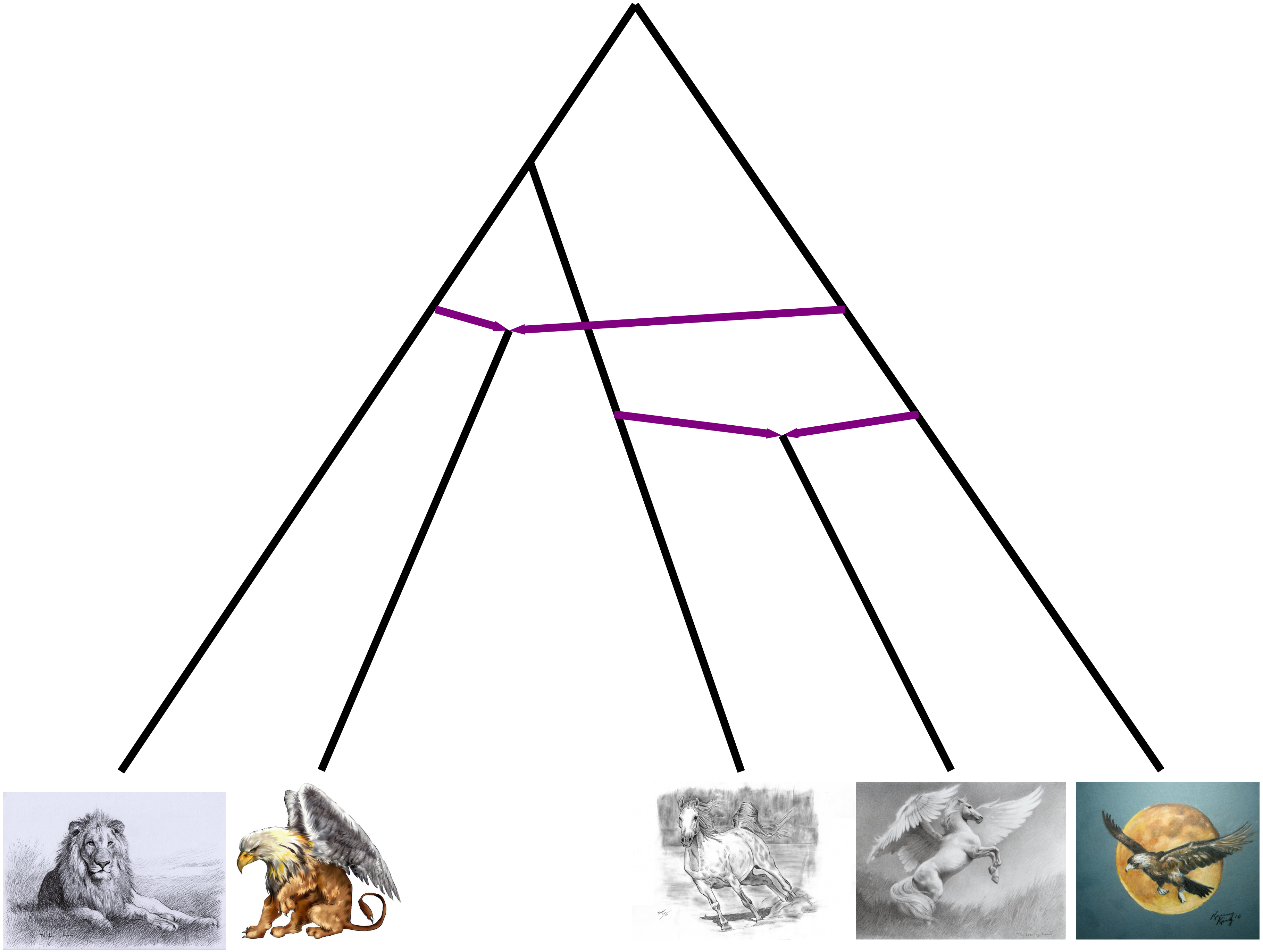
Phylogeny and Sequence Simulation with Hybridization

Michael Woodhams
School of Mathematics and Physics, University of Tasmania







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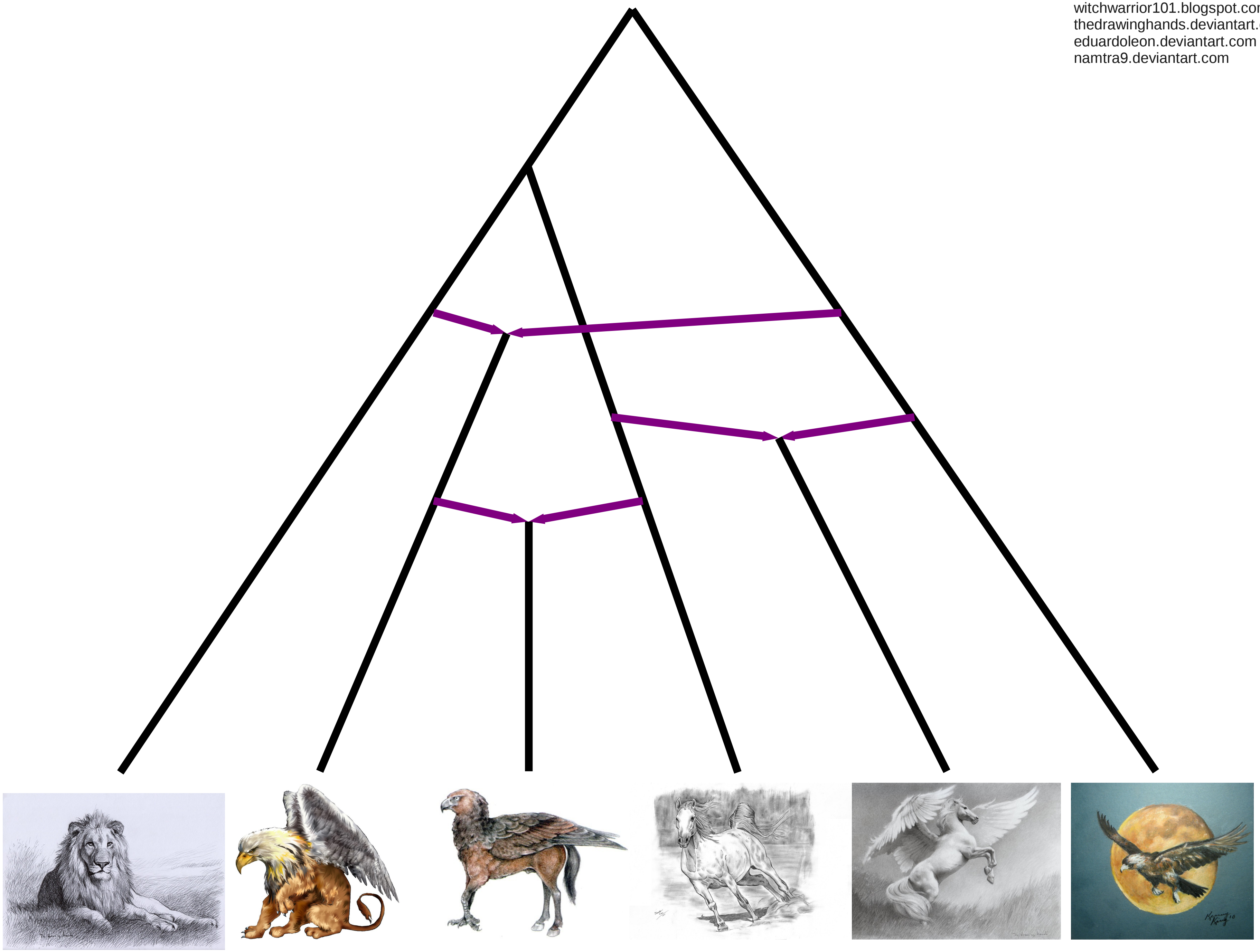
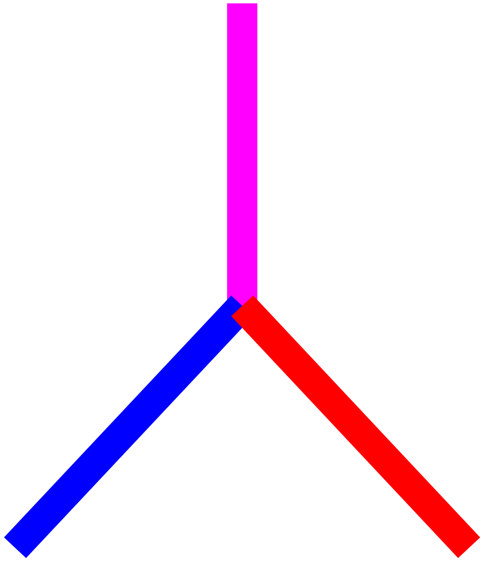


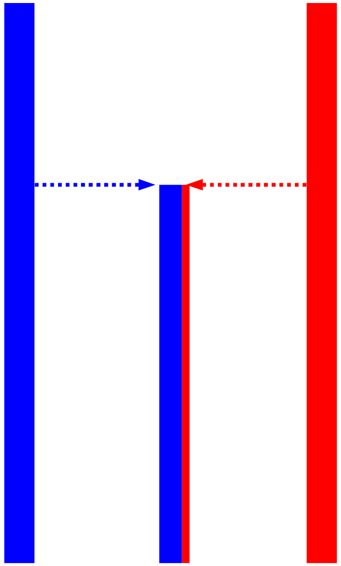
Speciation



Rate:

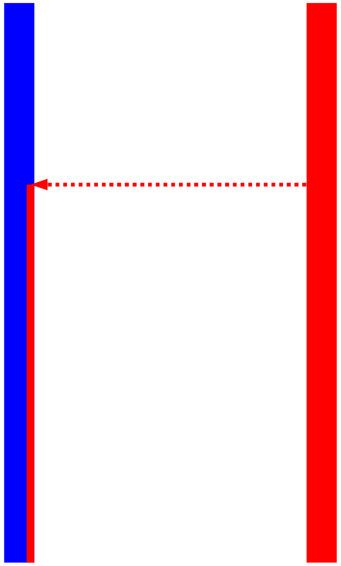
Base
x
N

Hybridization

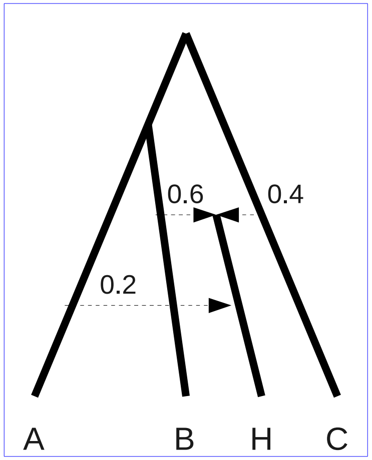


Base
x
N(N-1)
x
Success chance

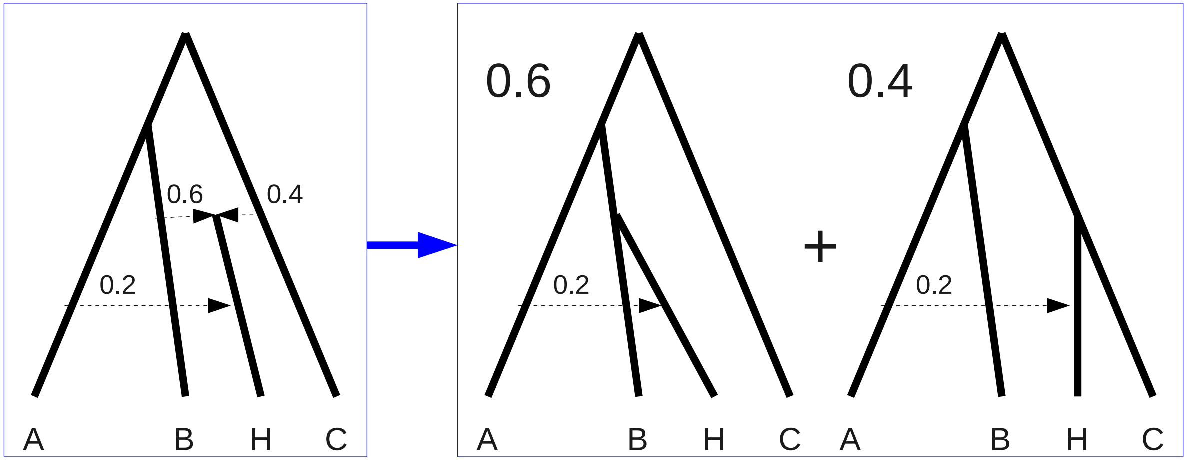
Introgression



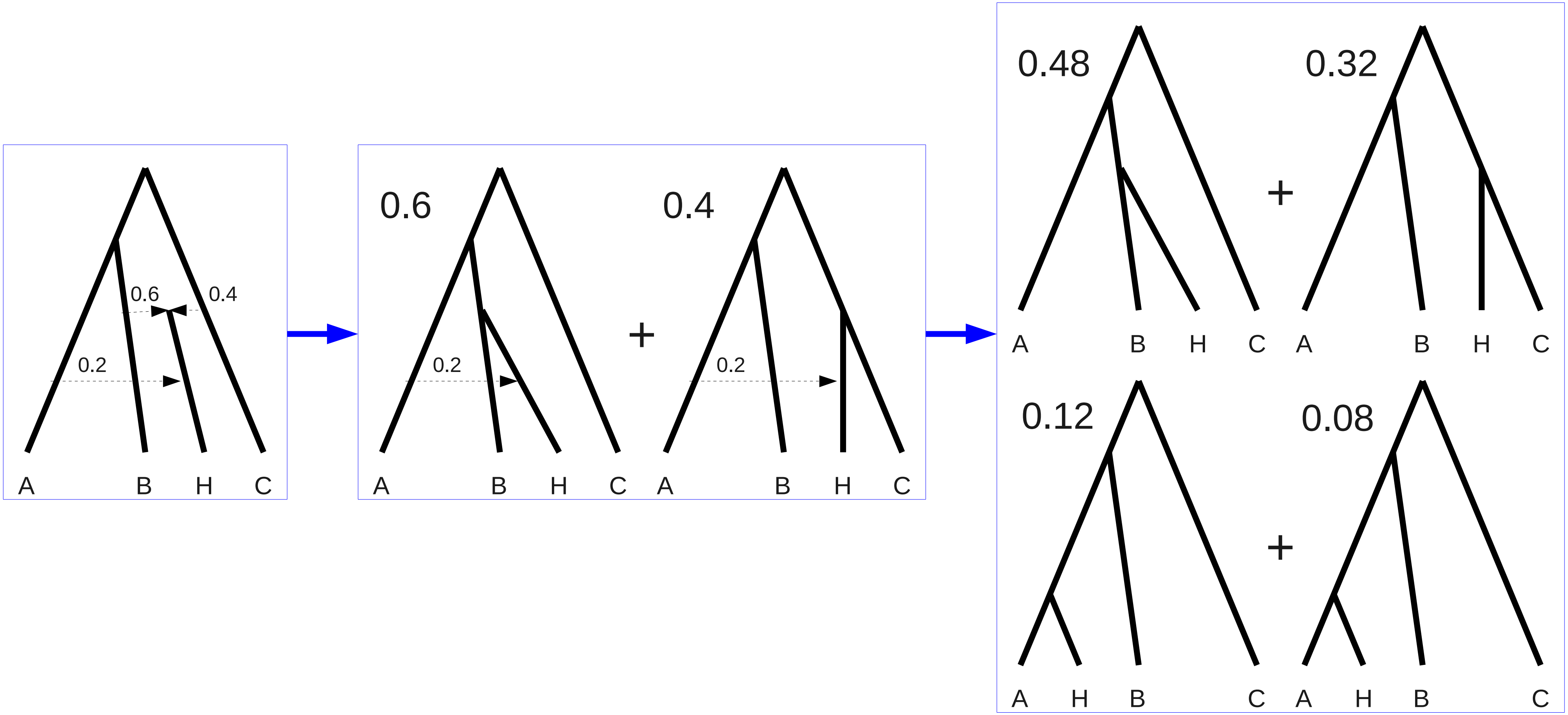
Base
x
N(N-1)
x
Success chance



Decomposing a hybrid network to weighted trees.



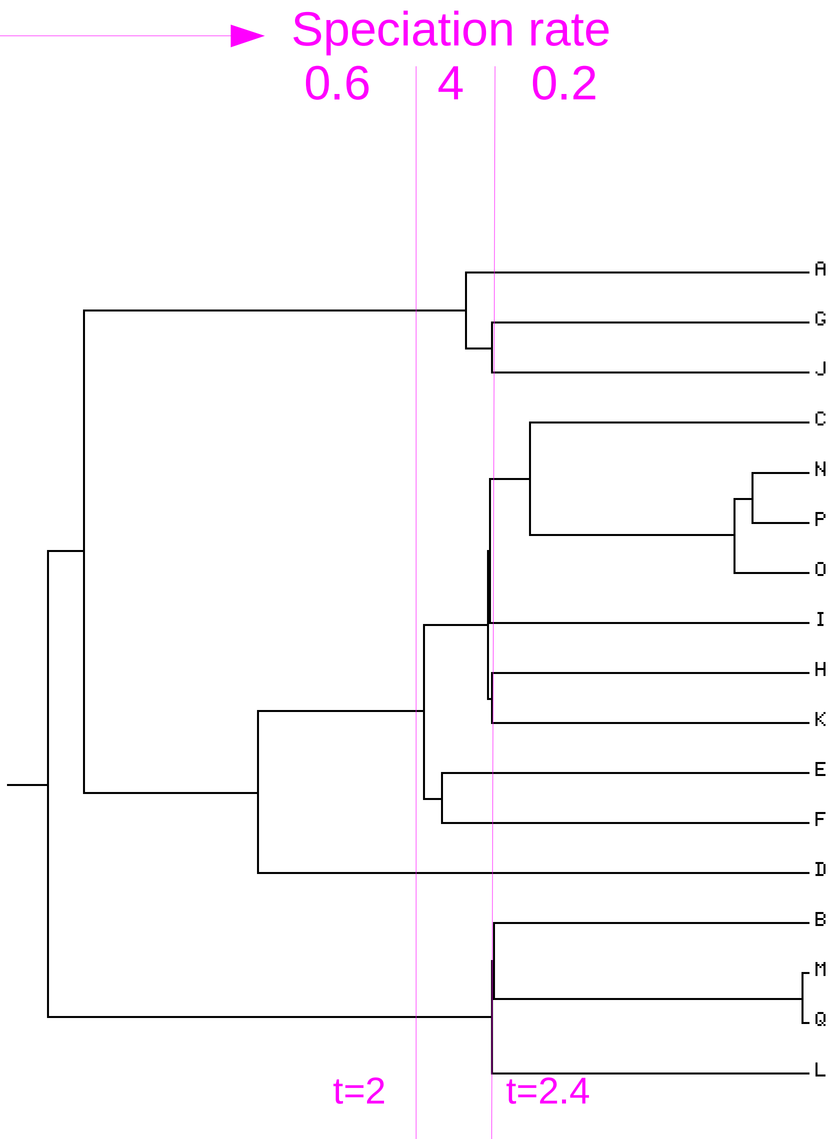
Decomposing a hybrid network to weighted trees.



Decomposing a hybrid network to weighted trees.

Input Parameters

```
speciation rate = (0.6,2,4,2.4,.2)
speciation function = linear
hybridization rate = 0
hybridization function = quadratic
introgression rate = 0
introgression function = quadratic
hybridization distribution = (0.25,1) (0.5,2) (0.75,1)
introgression distribution = (0.4,1) (0.5,2) (0.6,1)
halt time = 4
halt taxa = 30
halt hybrid = 30
seed = 4
hybridization threshold = .5
dollo rate = 0.06
dollo sites = 0
filo sites = 0
```



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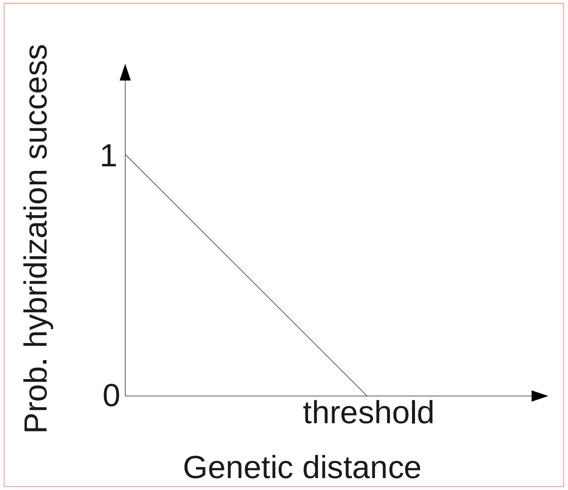

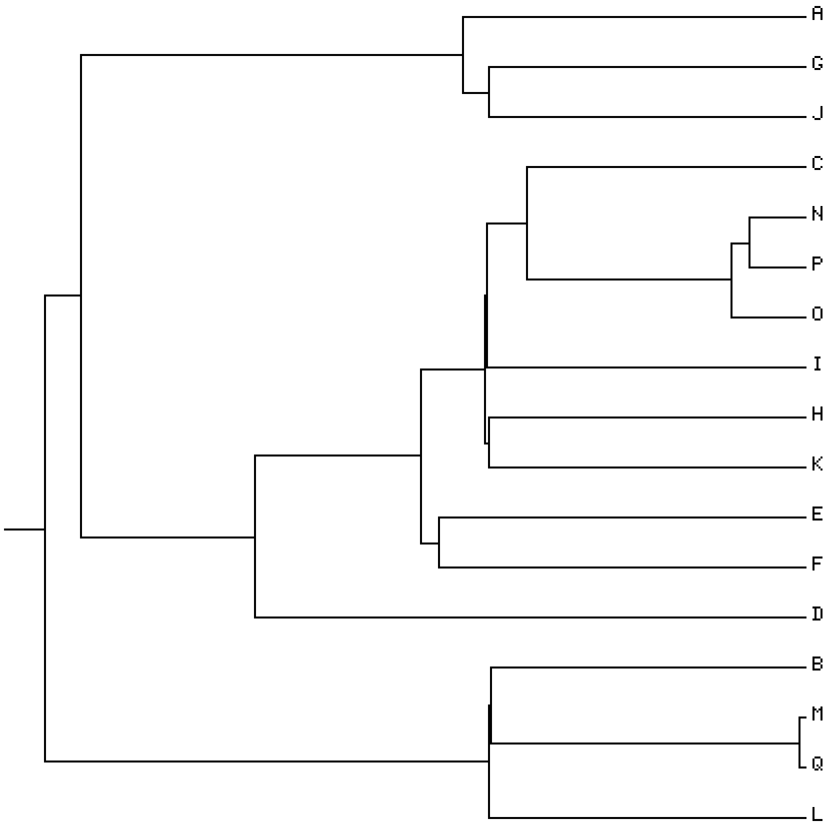

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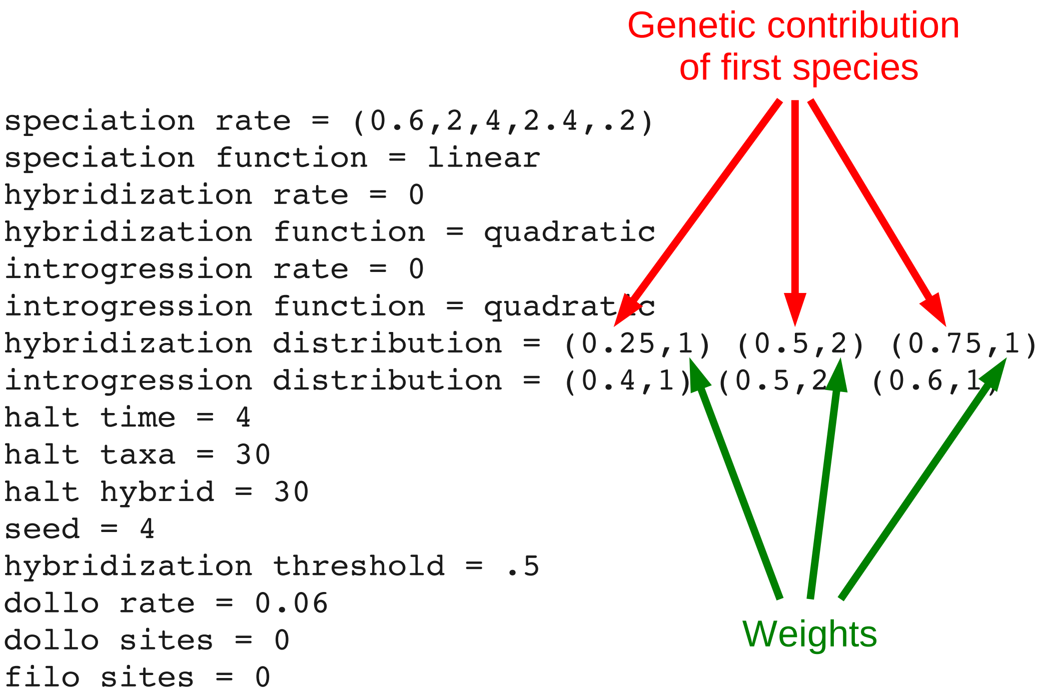

Genetic contribution
of first species

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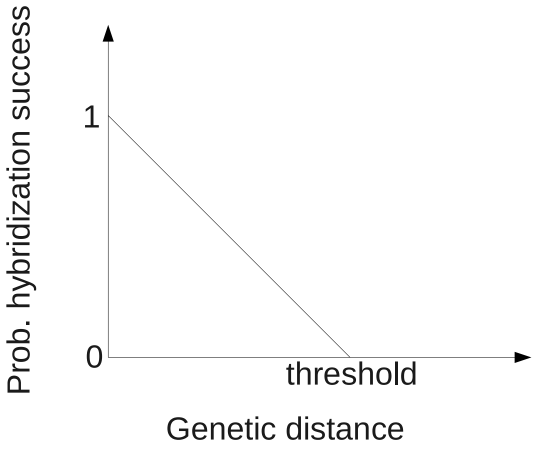
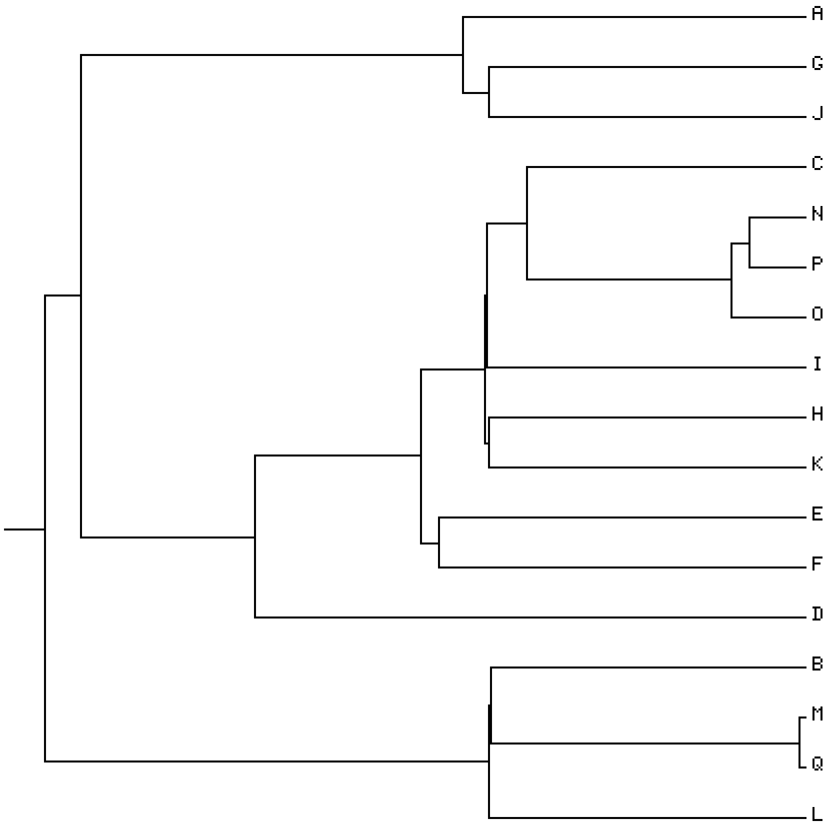
Weights





Input Parameters

Halts when any one
of these criteria is met.

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speciation rate = (0.6,2,4,2.4,.2)
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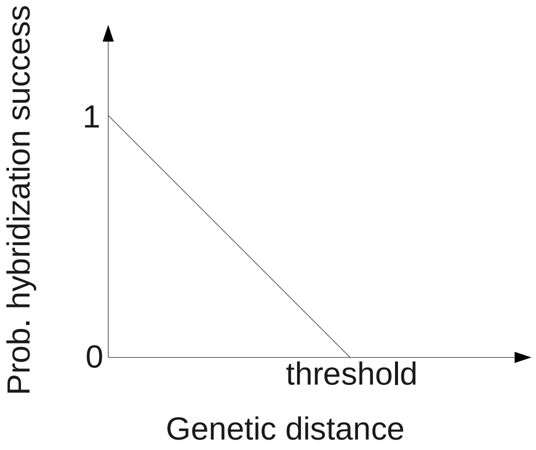

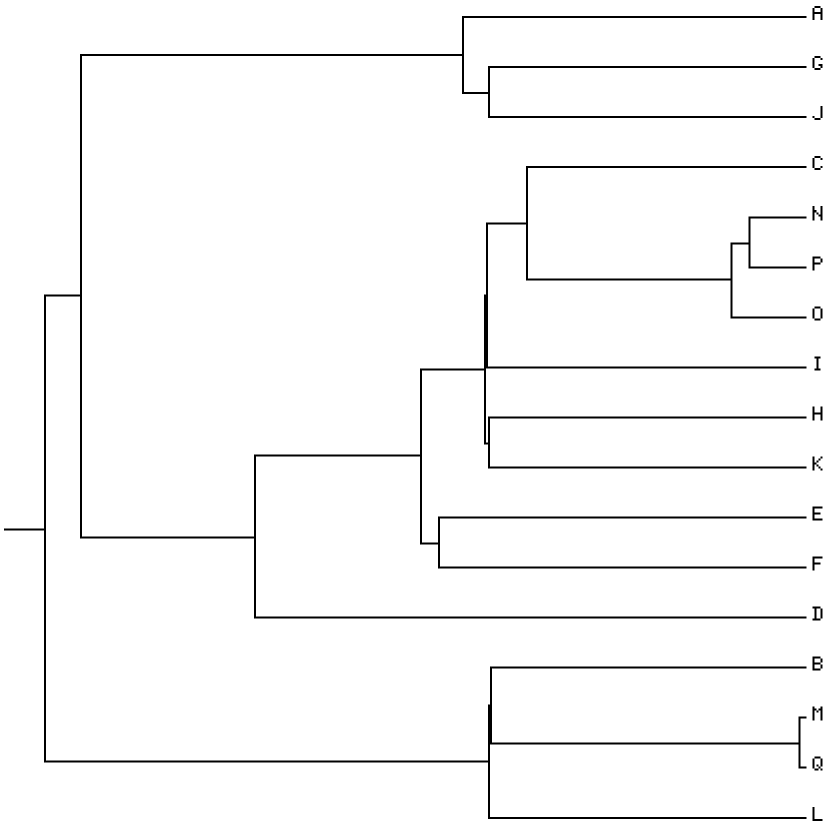

Filo feature

```
#NEXUS
begin filo;
      output
            format = fasta, nexus, raw
            filename = hybridoutput
            precision 5
      ;
      params
            indel 0
            ntrials = 10
      ;
      matrix HKY = HKY85 0.2 0.5 [ 0.25 0.05 0.25 0.45 ];
      run;
end;
```

```
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      output
            format = fasta, nexus, raw
            filename = hybridoutput
            precision 5
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      params
            indel 0
            ntrials = 10
      ;
      matrix HKY = HKY85 0.2 0.5 [ 0.25 0.05 0.25 0.45 ];
      tree T0 = ((A:0.45,C:0.45):0.06,(B:0.19,(D:0.15,E:0.15):0.03):0.32);
      treeparams T0
            l 54
      ;
      tree T1 = ((A:0.45,(C:0.15,E:0.15):0.30):0.06,(B:0.19,D:0.19):0.32);
      treeparams T1
            l 14
      ;
      tree T2 = ((A:0.45,(C:0.19,(D:0.15,E:0.15):0.03):0.26):0.06,B:0.51);
      treeparams T2
            l 28
      ;
      tree T3 = ((A:0.45,((C:0.15,E:0.15):0.03,D:0.19):0.26):0.06,B:0.51);
      treeparams T3
            l 4
      ;
      run;
end;
```

Dollo

```
>A
011111111110111011111111101111100111111111110011101110101111
>B
011101110110110111111111101111110111111111101011001110101110
>C
111111110110110101101111111111111000111111100011001100101101
>D
011101110110110101111111111111110111111111101010001110101110
>E
011101110111110111111111111111110110111111100011011110111110
```

All characters have same loss rate.

Gain location chosen randomly to keep number of characters present in equilibrium over the tree.

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