**Supplementary file 2.**

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| # | Trait 1 | Trait 2 | Model | Method | Commands |
| 1 | TerrestrialLungs | Site 1Site 2PYLungs | Discrete:Independent | ML1 | Res beta1 03 |
| 2 | TerrestrialLungs | Site 1Site 2PYLungs | Discrete:Dependent | ML | Res q24 q134Res q31 q42 0 |
| 3 | Site 1 | Site 2 | Discrete:Independent | ML | Res alpha1 alpha25Res beta1 beta2 |
| 4 | Site 1 | Site 2 | Discrete:Dependent | ML | Res q12 q136Res q21 q31Res q24 q34Res q42 q43 |
| 5 | Site 1 | Site 2 | Discrete:Dependent*unrestricted ancestral nodes* | MCMC2 | Commands from #4Prior q34 exp 0.001Prior q43 exp 0.001 |
| 6 | Site 1 | Site 2 | Discrete:Dependent*Trait 1 in ancestral nodes restricted to reflect divergent evolutionary model* | MCMC | Commands from #7AddTag TENaC Cow\_alpha Cow\_betaFossil ENaC TENaC 15AddTag Tbg Cow\_beta Cow\_gammaFossil bg Tbg 15AddTag Talpha Cow\_alpha SLamprey\_alphaFossil alpha Talpha 15AddTag Tad Cow\_alpha Cow\_deltaFossil ad Tad 15 |
| 7 | Site 1 | Site 2 | Discrete:Dependent*Trait 2 in ancestral nodes restricted to reflect divergent evolutionary model* | MCMC | Commands from #7AddTag TENaC Cow\_alpha Cow\_betaFossil ENaC TENaC 14AddTag Tbg Cow\_beta Cow\_gammaFossil bg Tbg 14AddTag Talpha Cow\_alpha SLamprey\_alphaFossil alpha Talpha 14AddTag Tad Cow\_alpha Cow\_deltaFossil ad Tad 14 |
| 8 | Site 1 | Site 2 | Discrete:Dependent*Trait 1 in ancestral node 1 restricted to reflect convergent evolutionary model* | MCMC | commands from #7AddTag TENaC Cow\_alpha Cow\_betaFossil ENaC TENaC 10AddTag Tbg Cow\_beta Cow\_gammaAddMRCA bg TbgAddTag Talpha Cow\_alpha SLamprey\_alphaAddMRCA alpha TalphaAddTag Tad Cow\_alpha Cow\_deltaAddMRCA ad Tad |
| 9 | Site 1 | Site 2 | Discrete:Dependent*Trait 2 in ancestral node 1 restricted to reflect convergent evolutionary model* | MCMC | commands from #7AddTag TENaC Cow\_alpha Cow\_betaFossil ENaC TENaC 11AddTag Tbg Cow\_beta Cow\_gammaAddMRCA bg TbgAddTag Talpha Cow\_alpha SLamprey\_alphaAddMRCA alpha TalphaAddTag Tad Cow\_alpha Cow\_deltaAddMRCA ad Tad |
| 10 | Terrestrial | PY | Discrete:Independent*Unrestricted ancestral nodes* | MCMC | Commands from #1PriorAll exp 0.001 |
| 11 | Terrestrial | PY | Discrete:Independent*Trait 2 in ancestral nodes restricted to reflect divergent evolutionary model* | MCMC | Commands from #10AddTag TENaC Cow\_alpha Cow\_betaFossil ENaC TENaC 14AddTag Tbg Cow\_beta Cow\_gammaFossil bg Tbg 14AddTag Talpha Cow\_alpha SLamprey\_alphaFossil alpha Talpha 14AddTag Tad Cow\_alpha Cow\_deltaFossil ad Tad 14 |
| 12 | Terrestrial | PY | Discrete:Independent*Trait 2 in node 1 restricted to reflect convergent evolutionary model* | MCMC | Commands from #10AddTag TENaC Cow\_alpha Cow\_betaFossil ENaC TENaC 11 |
| 13 | Terrestrial | PY | Discrete:Independent*Trait 2 in node 2 restricted to reflect convergent evolutionary model* | MCMC | Commands from #10AddTag Tbg Cow\_beta Cow\_gammaFossil bg Tbg 11 |

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| 14 | Terrestrial | PY | Discrete:Independent*Trait 2 in node 3 restricted to reflect convergent evolutionary model* | MCMC | Commands from #10AddTag Talpha Cow\_alpha SLamprey\_alphaFossil alpha Talpha 11 |
| 15 | Terrestrial | PY | Discrete:Independent*Trait 2 in node 4 restricted to reflect convergent evolutionary model* | MCMC | Commands from #10AddTag Tad Cow\_alpha Cow\_deltaFossil ad Tad 11 |