

Table S1 : Fossil calibrations

| Dataset | Node | Maximum age (My) | Minimum age (My) | References |
|---------|--|------------------|------------------|----------------------|
| Birds | Paleognathae / Neognathae | 86.5 | 66 | Benton et al. (2009) |
| | <i>Acanthisitta</i> / other Passeriformes | 65 | – | Benton et al. (2009) |
| | Sphenisciformes / Procellariiformes | – | 62 | Slack et al. 2006 |
| Mammals | <i>Pan</i> / <i>Homo</i> | 10 | 5.7 | Benton et al. (2009) |
| | <i>Pan</i> / <i>Hylobates</i> | 33.7 | 11.2 | Benton et al. (2009) |
| | Cercopithecoidea / Hominoidea | 34 | 23.5 | Benton et al. (2009) |
| | lemuriforms / other Primates | 65.8 | 55.6 | Benton et al. (2009) |
| | Feliformia / Caniformia | 65.8 | 39.7 | Benton et al. (2009) |
| | Suidae / Cetacea | 65.8 | 52.4 | Benton et al. (2009) |
| | Eulipotyphlans / other Laurasiatheria | 131.5 | 62.5 | Benton et al. (2009) |
| | Ochotoma / other Lagomorpha | 65.8 | 48.6 | Benton et al. (2009) |
| | sciuriforms / Caviomorpha + Myomorpha | 65.8 | 55.6 | Benton et al. (2009) |
| | Caviomorpha / Myomorpha | 58.9 | 52.5 | Benton et al. (2009) |
| | <i>Rattus</i> / <i>Mus</i> | 14 | 10.4 | Benton et al. (2009) |
| | Macroscelidea / Proboscidea | 131.5 | 48.4 | Benton et al. (2009) |
| | Afrotheria / other placentalia | 131.5 | 62.5 | Benton et al. (2009) |

Table S2 : Covariance between Kr/Kc and LHTs using the alternative birds topology of Hackett et al. 2008. The correlations without control (–) or controlling for base composition, . Change in polarity and volume are considered as radical substitutions.

| Control | Body mass | Longevity | Sexual maturity |
|---------------------|----------------|-------------|-----------------|
| – | 0.39 (0.99)** | 0.32 (0.91) | 0.11 (0.62) |
| π_c and π_r | 0.45 (>0.99)** | 0.35 (0.92) | 0.23 (0.80) |
| GC bias, AT/GC skew | 0.43 (>0.99)** | 0.33 (0.91) | 0.23 (0.80) |

* indicates $pp > 0.95$ or < 0.05 ** indicates $pp < 0.025$ or > 0.975

Table S3 : Covariance between Kr/Kc and LHTs excluding ND6. The correlations without control (–) or controlling for base composition. Change in polarity and volume are considered as radical substitutions.

| Datasets | Control | Body mass | Longevity | Sexual maturity |
|------------------|-----------------------------------|----------------|----------------|-----------------|
| | – | 0.35 (>0.99)** | 0.42 (>0.99)** | 0.63 (>0.99)** |
| Placentals (All) | | | | |
| | p _c and p _r | 0.30 (>0.99)** | 0.44 (>0.99)** | 0.51 (0.99)** |
| | GC bias, AT/GC skew | 0.32 (>0.99)** | 0.34 (0.98)** | 0.530 (>0.99)** |
| | – | 0.36 (0.98)** | 0.29 (0.89) | 0.08 (0.60) |
| Birds | | | | |
| | p _c and p _r | 0.40 (0.99)** | 0.32 (0.90) | 0.20 (0.77) |
| | GC bias, AT/GC skew | 0.37 (0.98)** | 0.29 (0.88) | 0.19 (0.77) |

* indicates $pp > 0.95$ or < 0.05

** indicates $pp < 0.025$ or > 0.975

References

- Benton MJ, Donoghue PCJ, Asher RJ. 2009. Calibrating and constraining molecular clocks. *Timetree Life*:35–86.
- Slack KE, Jones CM, Ando T, Harrison GLA, Fordyce RE, Arnason U, Penny D. 2006. Early penguin fossils, plus mitochondrial genomes, calibrate avian evolution. *Mol. Biol. Evol.* 23:1144–1155.